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PRINCIPLES OF SURGICAL PRACTICE

THE OBLITERATION OF CAVITIES

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THERE is no field in surgery in which one may not encounter the important and often difficult problem of obliteration of a cavity, which on account of the rigidity of its walls, or some other factor, will not heal spontaneously. Perhaps the thoracic surgeon is more often concerned with this problem than anyone else, yet the general surgeon, the orthopedist, the otorhinolaryngologist, the oral surgeon, and all the others are sure to find themselves faced, at some time, with the problem of cavities in which satisfactory healing is difficult to obtain. It would seem appropriate to discuss certain general principles that have bearing on the problem and subsequently to offer more detailed remarks about specific instances.

The fundamental principles of the healing of wounds, together with a historical review, have been thoroughly presented recently by Mason in the International Abstract of Surgery (Oct. 1939). Many of these principles are very simple ones, and may seem rather obvious, yet a periodic review of them is invaluable for anyone who is doing clinical surgery in any of its branches.

Cavities with rigid or semi-rigid walls can be satisfactorily healed (1) if the walls can be brought into contact, or (2) so nearly into contact that proliferating cells can eventually meet, or (3) if other living tissue can be made to occupy the space. Important factors in determining the healing tendency of cavities are the adequacy of the blood supply to the area, the severity and type of the infection, and general "body resistance" which in turn may be influenced by many constitutional factors.

The fibrosis associated with any granulating surface may be the decisive factor that limits tissue proliferation and "filling in" of the cavity, through increase of the rigidity of the walls and decrease of the local supply of blood.

The element of infection, as already mentioned, stands out as a prime consideration in the obliteration of cavities. Prompt and adequate drainage, maintenance of adequate drainage, prevention of "bottle necks" and "bays" by unroofing and exteriorization, and the judicious use of packing, are surgical principles which may need to be applied for the prevention of chronicity in infected cavities. Chemical sterilization of cavities has not been stressed so much in recent years as formerly. The widespread adoption of the Carrel-Dakin technique, with emphasis on meticulous detail in its application, followed the experiences of the World War. The careful protection of the adjacent skin, and the periodic delivery, to all surfaces of an infected cavity, of freshly prepared solution with adequate available chlorine, were almost universally adopted, the whole plan being guided by frequent bacteriological studies. There is still much to be accomplished by this type of management, particularly in speeding up the separation and removal of sloughing tissue. It is of especial value in cavities in which dependent drainage is difficult to establish, in those that are rather inaccessible, and in those in which scar tissue makes it difficult for an adequate blood supply to reach the infected surfaces. There has been widespread use of solutions, such as azochloramide, which are not irritating to the surrounding skin and apparently retain bactericidal ability for some hours in the presence of wound secretions, a great advantage over Dakin's solution with its very brief period of activity. The use of allantoin or urea, important factors in maggot-therapy, may also be of value in

cleansing a badly infected cavity. It should be repeated, however, that there is much less emphasis today on chemical sterilization of cavities, and that, similarly, there is less tendency to use "stimulants," such as balsam of Peru, aimed at the speeding-up of the granulating process.

Before proceeding to the discussion of the actual management of cavities that are difficult to heal, I should like to mention the important matter of avoidance of "dead space" in the closure of surgical wounds. Particularly in obese subjects, one may easily allow such spaces to remain after closure of the abdominal wall. It is generally agreed that all surgical wounds inevitably become contaminated with at least a few bacteria during operation. The accumulation of serum that "dead space" inevitably invites often results in clinically evident infections that would not have appeared in a dry wound. Subsequent conservative drainage procedures may leave a long narrow tract leading to an infected cavity, with tedious healing. Similarly, care must be taken to avoid the accumulation of large amounts of serum in such wounds as those that follow radical mastectomy. Careful hemostasis, the use of fine silk ligatures, and a suitable soft pressure-dressing should accomplish this. In other words, the surgeon must see to it that his own deeds (or omissions) do not actually have a hand in producing a troublesome cavity that is difficult to obliterate. As an example of this, one might mention the frequent utilization of the uterus in closure of the pelvic peritoneal floor in abdominoperineal resections of the rectum. The backward tilting and fixation of the uterus may assist greatly in the formation of a new pelvic floor, but may result in greatly increased difficulty in the ultimate healing of the perineal wound, because of the formation of a potential dead space, with the uterus as its roof. Still another example is to be found in careless closure of midline lower abdominal incisions, with a large dead space in the cavity of Retzius. It might be mentioned that this was the site of a troublesome infected cavity in the remarkable case reported by Kanavel, in which an extensive penetrating wound from a rake-handle resulted in the formation of a cavity with walls that were made rigid by the fibrosis of chronic infection. It defied repeated conservative efforts, but was finally healed by an ingenious double muscle pedicle graft from the recti muscles. The development of such troublesome cavities in traumatic wounds is rare, but the case reminds us that in extensive traumatic wounds, just as in surgical incisions, closure must entail the careful avoidance of "dead space" formation.

One further example of the prevention of complications in surgical cavities is to be found in the handling of the space which remains after the removal of a large substernal goiter. Here, because of upward pressure from below, there is a tendency toward rapid obliteration of the space. There is, however, no anatomical barrier whatever to downward extension in the event of the accumulation of fluid under pressure. If this fluid is infected, even mildly, the danger of mediastinitis is imminent. For this reason one must be sure to furnish adequate drainage through the cervical wound until the substernal cavity has completely filled in. It is even safer to pack the cavity with gauze, to stimulate the formation of a wall of granulation tissue which will act as a barrier to downward extension, in the event of a delayed accumulation of fluid in the cavity.

There are certain tissues in which large cavities tend to close readily. In the brain, for instance, a large space may be obliterated in a very short time through edema, extension of a ventricular space, and other factors. Following the removal of a large meningioma, the re-elevation of the bone flap (due to clinical signs that lead to the diagnosis of probable postoperative hemorrhage) may reveal the large cavity almost closed. Similarly, a large brain abscess cavity may disappear following simple closed aspiration of the pus on one or more occasions. One can make much the same statement in regard to the behavior of the liver, in which a huge abscess cavity may disappear following simple aspiration, combined with appropriate anti-amebic therapy when indicated.

With small rigid-walled infected cavities, such as many of those with which the oral surgeon has to deal, careful repeated packing and routine cleanliness usually result in progressive healing, with sufficient proliferation to fill the space, and final epithelialization with not enough depression to be of consequence. Similarly, with small superficial cavities, such as those which follow the removal of an infected pilonidal cyst, loose packing for a few days, plus simple cleanliness, will be followed by satisfactory healing in a few weeks. The slow healing constitutes somewhat of an annoyance, and if the cyst be large and the area of excision extensive, one is tempted to save time by sliding a mass of tissue into the defect by some simple plastic procedure. If this is done, both ends of the flap should be left attached, and care should be taken to anchor its deeper portions to the fascia over the sacrum so that a dead space is not produced.

The more elaborate procedures that are directed at the obliteration of cavities with non-collapsible

walls are usually essential features of a surgical plan to control chronic suppuration (osteomyelitis, chronic suppurative pleurisy). They may be, much less commonly, indicated for cosmetic reasons.

The principle of bringing cavity walls into contact might be exemplified in its simplest form by the case in which suppuration in a frontal sinus can be controlled only by unroofing it, and "caving in" the anterior wall to meet the posterior. Subsequent plastic measures may be taken, after a safe period has elapsed, to relieve the deformity. The most widespread application of the methods of obliteration of infected cavities is made, of course, by the thoracic surgeon. The advances in this work have been truly amazing. Alexander's excellent review has shown that carefully staged procedures have halved the mortality of thoracoplasty, while meticulous attention to improved technical details has doubled the percentage of patients whose tuberculous cavities have completely closed. Of 119 of his recent patients, 106 were alive and of these 93.4 per cent had closed cavities, as shown with x-rays, and continuously negative sputum. The positive-pressure cavities, associated with bronchial stenosis, constitute a special and difficult group.

Another large field for the thoracic surgeon is the management of chronic empyema cavities. The presence or absence of a bronchial fistula is a large factor in the determination of the prognosis and treatment, but the basic problem is to bring the walls into contact. Prompt and adequate management of acute empyema should go far toward preventing progression to the stage of chronicity, but the problem of chronic empyema is a fairly common one. The ascent of the diaphragm, narrowing of the intercostal spaces on the affected side, and tendency of the lung to expand, together with overexpansion of the contralateral lung, tend to close the cavity. The removal of a thick, fixed visceral pleura, with release of the lung (decortication) was aimed at bringing the inner wall out into contact with the outer wall. Similarly, the various thoracoplastic procedures were aimed at allowing the outer wall to be depressed to meet the inner wall.

The use of large pedicled muscle flaps (notably from the latissimus dorsi), suggested nearly forty years ago, has been of such value in the obliteration of large chronic empyema cavities as to be accepted as a standard procedure in suitably selected cases. The insertion of muscle flaps into bronchial fistulous openings, with careful fixation, has been proved of value in effecting closure. The same principle is now being used in pneumonectomy as a measure to prevent the development of a fistula, except that the bit of muscle used is a free graft.

Less commonly used and less successful, and with rarer indications, is the insertion of free fat grafts into persistent small or moderate-sized bronchopulmonary cavities(the trabeculated "lattice-lung" type). Even in the presence of residual infection and some epithelialization of the cavity, these free fat grafts have been of value in furthering closure in a fairly high percentage of cases. It is certain that the fat, as such, does not long survive. It serves as a space-filler, however, and in all probability there occurs a temporary "take," with subsequent fibrous-tissue replacement that tends to draw the walls of the cavity toward one another.

The use of free fat grafts in chronic osteomyelitic cavities has been resorted to in occasional cases with some success. Martin reported successful instances before the New York Surgical Society some twenty years ago.

The permanent surgical cure of chronic osteomyelitis is notoriously difficult, and it is to be hoped that in the future the development of chronicity will be prevented in a higher percentage of acute cases. A notable advance in this direction is the treatment advocated by Orr some twelve years ago, with the avoidance of frequent dressings, adequate rest, and protection of the affected part. With chronic osteomyelitic cavities, such as those to which the term "Brodie's abscess" is commonly applied, the problem is mechanically a difficult one. The cavity has rigid walls and is often deeply placed and relatively inaccessible, as for example in the lower third of the femur. In addition, it is very difficult to determine the limits of the infection in the adjacent bone, or to be sure that all infected material has been removed. With small cavities, one may resort to adequate "unroofing" and "saucerization," and conservative mobilization of the adjacent soft parts, which can be "crowded in" to fill the space. With larger cavities, after proper preparation, extensive pedicled muscle grafts may be inserted; they have proved invaluable in suitable cases. In regard to the use of pedicled flaps, it might be well to mention the ingenious flap devised by Kanavel for one of his cases. There was a deep unsightly hole in the forehead, the result of luetic osteomyelitis communicating with a large frontal sinus. A pedicled flap from the forearm was used, and was so fashioned that the subcutaneous-tissue flap was twice as long as the skin flap. This permitted folding-under of the fat, which filled the cavity nicely.

A most interesting method of dealing with large bone cavities is that of attempting to secure complete epithelialization of the cavity without obliteration. The cavity is "unroofed" and carefully prepared with the same mechanical principles as used in the preparation of a tooth to receive an inlay. Healthy granulations are secured by packing and repacking every forty-eight hours and by warm saline irrigations. A mold of the cavity is made with any standard dental-impression composition. When granulations are healthy, large split-thickness skin grafts are applied (with cut surface facing out) to the mold, which is replaced in the cavity, to remain ten days. This method (Esser and Gillies) may result in the permanent healing of large osteomyelitic cavities when others have failed. Desquamated epithelium tends to accumulate in the depths of the epithelial pouch, but causes little concern since it may be easily removed by occasional attention with a small camel's-hair brush.

A similar method is employed by the eye surgeon in cases of complete exenteration of the orbit. This operation, performed for certain malignant tumors and involving, as it does, removal of the lids and periosteum, as well as of the orbital contents, leaves a large cavity as a problem in healing. This is easily solved by the immediate application of Thiersch grafts, held in place by a suitable tampon. These "take" consistently and promptly, even if the periosteum has been removed from the orbital walls, remarkable as this may seem. The large rigid-walled cavity is thus healed, at once, by the application of an epithelial lining.

RÉSUMÉ

An attempt has been made to review the general principles of the management of cavities in which it is difficult to obtain satisfactory healing, and to present a series of illustrative instances that present various phases of this problem. These cavities may occur in any part of the body, and may be encountered by anyone doing surgery in any of its special divisions. No attempt has been made at a detailed technical presentation, which would lead one into a tedious and lengthy exposition. The purpose has been to discuss the basic principles of wide applicability, which it is well to review at frequent intervals.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Havens, F. Z.: Benign Cysts and Adamantinomas of the Jaws. *Arch. Otolaryngol.*, 1939, 30: 762.

This paper deals mainly with the group of larger cysts, and with adamantinomas. It is based on the study of a series of 198 benign cysts and of 58 adamantinomas, approximately a third of the cases in each group having come more or less closely under the author's observation.

For clinical consideration of cystic odontomas and benign cysts of the jaws of non-dental origin, the following outline is helpful:

1. Cystic odontomas
   a. Follicular cysts
      (1) Those containing an associated tooth
      (2) Those not containing an associated tooth
   b. Adamantinomas
2. Cysts of inflammatory origin
3. Cysts of traumatic origin
4. Cysts of indeterminate origin
5. Cysts developing from non-dental embryonic rests
   a. Median anterior maxillary cysts
   b. Facial cleft cysts

In the differential diagnosis the following lesions must be borne in mind. Clinically and roentgenologically any of them may be indistinguishable from a cyst. Exploration and biopsy may be necessary to establish the true diagnosis.

1. Giant cell tumor
2. Uncalcified solid odontoma
3. Fibroma
4. Dermoid
5. Angioma
6. Hemangio-endothelioma
7. Metastatic malignancy
8. Osteitis fibrosa cystica
9. Paget's disease
10. Fibrocystic disease
11. Sarcoma
12. Chondroma
13. Squamous-cell epithelioma invading the jaw

Follicular cysts. Often, in cases in which roentgenological examination reveals a cyst containing a tooth, it can be noted that a tooth is absent from the number normally present in that region. Occasionally, however, the full quota of teeth will be present and the tooth in the cyst will prove to be an anomalous one. Rarely a tooth will be missing and a cyst will be found which does not contain a tooth; in such cases one must assume that the enamel organ failed to function.

These cysts affect males and females with about equal frequency and they are a little more likely to be found in the lower than in the upper jaw. They are discovered with equal frequency in the third, fourth, fifth, and sixth decades of life, about half as frequently in the second and seventh decades, and only occasionally at other ages.

Follicular cysts may produce no symptoms and may be found only on routine roentgenological examination. When present, symptoms most often are of six months' duration or less, although some patients describe symptoms dating back as long as two years, and occasionally longer.

The diagnosis usually can be made with reasonable assurance on roentgenological examination. The smooth bony cavity is clearly outlined without evidence of thickening of the margins. The cyst almost always is unilocular.

Treatment consists of complete removal of the lining membrane and of one wall of the bony cavity in order to convert it into a saucer-like depression. The lining usually strips out readily. Recurrence rarely takes place following this method of treatment.

Cysts of inflammatory origin are known as "radicular cysts" and result from infection at the tip of a pulpless tooth. They may or may not have an epithelial lining. The epithelial lining in a cyst of inflammatory origin is believed to develop from fragments or remnants of Hertwig's sheath. If an epithelial rest lies in the wall of an abscess, the cells proliferate to provide a lining for the cavity of the abscess.

Usually these cysts are small and often they adhere to the root when the tooth is extracted. Occasionally they become quite large, and unless there is an associated pulpless tooth such a cyst may be indistinguishable from a follicular cyst of the type which contains no tooth.

Stafne has called attention to the fact that similar cysts apparently may develop around retained deciduous roots.

Ivy and Curtis have recently given an excellent description of cysts of traumatic origin. They are analogous to those non-epithelial-lined cysts of long bones which have been believed to result from hematoma formation following trauma. An injury insufficient to cause fracture may lead to hemorrhage in the medullary portion of the bone.

Occasionally a cystic cavity may be found in the mandible of a child or young adult who gives a history of trauma a few weeks previously. Usually there is a moderately painful swelling of the bone at the point of injury. Roentgenological examination reveals a cavity in the bone along the course of the

inferior dental canal, and with no apparent connection with the roots of the overlying teeth. It may be impossible, without exploration, to differentiate such a cavity from a cyst of dental origin, particularly if some of the overlying teeth are pulpless.

If the cavity is found to be unlined at operation, and the contents present evidence of hemorrhage, the traumatic origin of the cyst is highly probable. Evacuation of the contents of the cavity is usually all that is necessary to bring about a cure.

There are no clinical or roentgenological findings to differentiate cysts of indeterminate origin from other cysts. The findings at operation are so characteristic, however, as to justify a separate classification for the group.

The treatment need not differ from that for other benign cysts.

Median anterior maxillary cysts are of non-dental origin and are situated in the region of the anterior palatine canal.

A persistent canal or the proliferation of portions of persistent epithelial cords might give rise to an epithelial-lined cyst. These cysts are found anteriorly in the middle of the upper jaw, just above or partially between the root tips of the upper central incisors. They seldom give rise to symptoms and usually are discovered in the course of routine dental roentgenographic examination. Stafne has given an excellent description of the normal roentgenographic appearance of this area and of its appearance when a cyst is present. The treatment is surgical with removal of the lining of the cyst.

Facial cleft cysts. In the second month of fetal life there appear on both sides of the nasofrontal process 2 ectodermal thickenings, the medial nasal process and the lateral nasal process. Between the 2 thickenings, on both sides, is a depression, the future nasal vestibule. As development progresses the two medial processes fuse to form a single median process, which eventually forms the middle portion of the upper lip, jaw, and part of the nasal septum. The lateral nasal process forms the lateral wall and ala of the nose. The fusion of the maxilla with the median and lateral processes completes the formation of the upper jaw, lip, and nose. Complete failure of closure results in harelip and cleft palate. Persistence of epithelial remnants in the line of closure undoubtedly may occur, and it is believed that these give rise to cysts in this region.

Treatment consists of removal of the lining, which usually is readily accomplished through an incision under the upper lip. Occasionally, in cases in which the cyst elevates the floor of the nasal vestibule, it is impossible to separate the wall of the cyst from the skin of the floor of the nose and a small portion of the latter must be removed. This has not been found to cause any trouble.

An adamantinoma of the jaw results when paradental embryonic epithelial remnants proliferate with little or no differentiation of the cells.

The adamantinoma is a malignant tumor made up of nests of cells in a stroma of normal connective tissue. These masses of cells resemble in varying degree the epithelial structures present in the embryonic stage of development of the normal tooth. Early, the tumor is solid, but cystic degeneration soon appears and gives it a characteristic multilocular cystic arrangement. The tumor is a very slow growing inactive type of malignancy. Some pathologists believe it should be classified as a non-malignant neoplasm. However, it will grow uninterruptedly, it will recur persistently if incompletely removed, and it will give rise to metastasis. All of these characteristics are clinical earmarks of a malignant tumor.

The patient with an adamantinoma frequently describes only one symptom; namely, a slowly enlarging tumor of the jaw.

Adamantinomas occur most commonly in the lower molar and bicuspid regions.

The diagnosis may be suspected in the advanced case from the long history of a good-sized tumor of the jaw which has not invaded the soft tissues. Sometimes a crackling sensation can be elicited on palpation of prominent portions of the tumor, and sometimes there is a history of spontaneous or surgical drainage of straw-colored fluid. Roentgenographically, the multilocular cystic arrangment of the bony shell and trabeculæ is characteristic.

The treatment of adamantinoma, to be successful, must be surgical and radical. Because the growth of the tumor is so slow the temptation is to employ conservative measures such as curettement, with or without chemical or thermal cauterization of the wound, and perhaps combined with irradiation. Such methods of treatment have been widely used and the percentage of failures has been high.

The reason for the high percentage of failures following the conservative types of treatment can be seen readily on examination of microscopic sections which include the outer portion of the tumor together with the adjacent shell of bone. In these, microscopic finger-like extensions of the tumor into the bone can be seen. Obviously, curettement or any similar measure is likely to fail to remove all of them.

In the use of surgical diathermy the entire tumor is coagulated and the surrounding bone is cauterized sufficiently to cause a sequestrum of at least 5 mm. in thickness to form. Tumors involving a considerable proportion of the thickness of the mandible can be removed in this way, a bridge of normal bone being left. This bridge will thicken appreciably during the two or three months required for separation of the sequestrum, and in many instances a surprisingly narrow remnant will thicken sufficiently to maintain the contour and function of the jaw.

If resection of the mandible is necessary, diathermy is admirably suited for this also. The mandible is exposed and severed anterior to the growth. The diathermy electrode is then applied to the cut end of the bone containing the tumor and a strong current is used to raise the temperature of the bone until the periosteum is blanched and rendered friable. The soft tissues can then be separated from

the heated portion of the bone with the finger and the charred bone cut away. This process is repeated as often as necessary to remove the desired portion of the mandible together with all the expansions made by the tumor. After exposure and section of the mandible, the operation is practically bloodless, so that the extensions of tumor can be identified and removed with a high degree of certainty.

Most of the benign cysts of the jaws arise as a result of proliferation of dental embryonic rests. They are readily amenable to appropriate conservative treatment.

The adamantinoma, likewise, arises from dental embryonic rests. It, however, is a malignant tumor and radical surgical treatment is required for its cure.

EYE

Goar, E. L., and Schultz, J. F.: Iridencleisis in Glaucoma. *Arch. Ophth.*, 1939, 22: 1035.

The authors describe and illustrate iridencleisis and give a detailed statistical account of the good results obtained in a large number of patients operated upon by different surgeons.

They believe the advantages of this operation are:

1. The operation disturbs the eye little, and seldom is there appreciable iritis.
2. Usually little change in refraction is produced.
3. The anterior chamber is quickly reformed, and there is no prolonged hypotony. In fact, the tension may be a trifle elevated for awhile, so that miotics may be necessary for a few weeks.
4. The filtering scar usually is permanent.
5. Late infection is rare. In a large series of cases Erola found that it was about one-fifth as frequent as following the trephine operation. The authors have had several patients who contracted acute conjunctivitis after iridencleisis without intra-ocular infection.
6. A shallow anterior chamber does not make the operation more difficult.
7. The anterior chamber can be emptied slowly. It is usually unnecessary for any instrument to enter the anterior chamber.
8. The scratch incision enters the anterior chamber much closer to the base of the iris than the conventional keratome incision. Scratching or rupture of the anterior lens capsule does not occur.

The authors recommend iridencleisis by scratch incision as a safe and efficient operation for the types of glaucoma for which it is adapted. It is useful for the occasional operator as well as for the ophthalmic surgeon of large experience. It merits greater prominence than it has received.

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Pischel, D. K., and Miller, M.: Retinal Detachment Cured by an Eyeball-Shortening Operation: Report of a Case. *Arch. Ophth.*, 1939, 22: 974.

The author reports a case of an eyeball-shortening operation, which is a modification of Mueller's operation as described by Lindner in 1933. He summarizes his results thus:

The operation resulted in complete reattachment of the retina, with great improvement of vision and restoration of a normal visual field. The refraction of the eye was changed from a −4.50 spherical, −0.50 cylinder, axis 90, to a −1.00 spherical, −2.50 cylinder, axis 25, which gave a vision of 15/100.

LESLIE L. MCCOY, M.D.

NOSE AND SINUSES

Parkinson, S. N.: Non-Traumatic Ventilation Treatment of the Nose and Sinuses. *J. Laryngol. & Otol.*, 1939, 54: 611.

The past decade has brought many changes in the local treatment of infection of the nose and sinuses. Two of these changes appear to be outstanding: one, the use of drugs and vehicles compatible with nasal physiology; the other, the use of head-low posture to permit the application of medication to the nasal sinus area. The use of a physiological drug in a physiological vehicle in local treatment is a logical advance. It signifies recognition of the nasal-sinus mucous membrane as a functioning organ rather than as merely an inert lining. The value of a drug for local treatment has come to be based realistically upon the evidence of useful action associated with demonstrable lack of harmful reaction.

Correctness in a vehicle depends on its similarity to the nasal secretion. A perfect vehicle would be compatible with nasal secretion and with the fluid content of the epithelial cells lining the nasal sinus tract. It would be entirely inert, and thus would fulfill the proper function of a vehicle: no action, no reaction, simply a medium through which drug action is transmitted. A physiological solution of sodium chloride with a stable pH, slightly more alkaline than blood pH, appears to be a satisfactory vehicle.

Head-low posture permits the administration of local treatment. It is designed to make available all parts of both nasal fossæ simultaneously, regardless of the structural variation and distortion. By making allies of fluid and gravity it minimizes the importance of spurs, angulations, hypertrophies, and other irregularities as obstacles to ventilation and drainage.

The purpose of local treatment is to increase ventilation, both for its own sake and in order to improve sinus drainage. Shrinking the nasal mucous membrane opens the meatuses and the sinus ostia. Free egress of accumulated sinus contents then can take place by ciliary activity. This will be most certain and adequate if in the process of ventilation the ciliary mechanism has not been damaged. Only a physiological drug in a physiological vehicle will produce the desired shrinkage by vasoconstriction without damage to the ciliary mechanism and to the underlying epithelium. A physiological solution of sodium chloride made with tap water, sterilized by

boiling, and free from preservatives and antiseptics, appears to be a satisfactory vehicle.

The lateral head-low posture is designed in accordance with the anatomy of the nose and sinuses. In the same sense that the medication may be termed physiological, the posture for its administration may be termed anatomical, for postural treatment of the nasal sinus tract is applicable alike to infants, children, and adults. Yet it would not be quite true to say that it is easily comprehended or readily accepted by all who hear of it. One's first impulse is to reject the lateral position and to insist on a forward or backward position. Only consideration of regional anatomy makes it plain that the lateral position is symmetrical for the nasal sinus area.

The lateral head-low position is attained as follows:

The patient is seated upon a cot, and beside him are placed one or more pillows. He is then bent down laterally so that his shoulder rests on the far edge of the pillows. The shoulder and the pillows together act as a fulcrum. The head is now bent downward so as to be inverted in a strictly lateral position. The extent of inversion of the head will necessarily vary with the ability of the patient, but 45 degrees is probably adequate, and satisfactory treatment appears to result from less. The patient is instructed to breathe orally while the solution is in the nasal chambers so as to avoid snuffing it into the pharynx. The amount each chamber will hold varies, but for small children 1 dropperful, and for adults 2 dropperfuls on each side, are suggested. At the termination of the treatment—three to five minutes—the patient's head is rotated to face downward and the solution is allowed to drain out through the nostrils. At no time need one drop enter the pharynx.

In the actual carrying out of treatment there should be preliminary shrinkage of the nasal mucous membrane. The nose is sprayed from an atomizer containing 1 per cent of ephedrine in physiological salt solution. This is permitted to remain in the nose unmolested for from five to ten minutes. If the mucous membrane is sufficiently shrunken, the patient then cleanses his nose by blowing while leaving the nostrils entirely unobstructed. He is then placed in the lateral head-low position. Warmed ephedrine solution is instilled into both nasal chambers simultaneously. After from three to five minutes he is turned face downward.

Ephedrine in physiological solution and lateral head-low posture have worked well for routine treatment of infection of the nose and sinuses. Whether in maxillary, frontal, ethmoid, or sphenoid sinuses, acute inflammation is treated by this method which combines safety and lack of discomfort. Parkinson's results encourage its continuance. Rare indeed is the necessity for such traumatic interference as antrum lavage via puncture or ostium, and this also is true for the acutely inflamed frontal or sphenoid sinuses.

NOAH D. FABRICANT, M.D.

PHARYNX

Campbell, E. H.: Tonsillectomy: Local Results and Influence of the Operation on Surrounding Tissues. *Arch. Otolaryngol.*, 1939, 30: 863.

The problem of the recurrence of tonsillar tissue following tonsillectomy is one that has received much consideration. Tonsillectomized patients are constantly returning to those who operated on them, not only without symptomatic benefit but with throats showing the signs of incomplete and poorly performed operations. In this article the author reveals the results of a statistical study of tonsillectomized persons with regard to the recurrence of tonsillar tissue, injury to the faucial pillars, and hypertrophy of pharyngeal lymphoid tissue, and draws a comparison between the results obtained by practitioners and those obtained by specialists. No attempt is made to evaluate the results from the symptomatic standpoint.

During the years 1936, 1937, and 1938 Campbell examined 887 girls entering the freshman class at the University of Pennsylvania. Their ages ranged from eighteen to twenty-one. Only 30 per cent of the 887 students examined had not had their tonsils removed. Of the 621 students who had been operated on, 77.3 per cent showed tonsillar remnants in the fossæ. Of the group of 153 students who underwent more detailed investigation, 54.9 per cent were found to have an excessive amount of lymphoid tissue in the pharynx and 22.8 per cent showed scarring of the palate, pillars, or fossæ. Of these 153 patients 67.3 per cent had been operated on by otolaryngologists and 28.7 per cent by family physicians. Of the 103 students who had been operated on by specialists, 74.7 per cent showed tonsillar remnants, 14.5 per cent showed scars, and 25.3 per cent had no lymphoid tissue in the tonsillar fossæ. Of the 44 students operated on by family physicians 79.5 per cent showed tonsillar remnants, 40.9 per cent showed scars, and 20.5 per cent had fossæ free from lymphoid tissue. One hundred per cent of the 21 students who had been operated on before the fourth year of age showed remnants of tonsillar tissue in the fossæ; 73.4 per cent of the 94 students who had been operated on between the fourth and tenth years of age showed lymphoid tissue in the fossæ; and 96.1 per cent of 26 students operated on after the tenth year of age showed recurrence of tonsillar tissue in the fossæ.

The noteworthy feature of the results obtained in this investigation is the extremely high incidence of recurrence of tonsillar tissue following tonsillectomy. Probably the most outstanding reason for this is the inefficiently performed operation, that is, the tonsil is incompletely removed, a remnant being left in the fossa, usually in the lower pole. The chief factors concerned in this are: improper administration of the anesthetic; inadequate illumination of the operative field; unskillful assistance at the operation; and imperfect inspection of the fossæ. All surgeons who perform tonsillectomy many times eventually

reach the conclusion that tonsillectomy is not the easy or minor operation that it is so commonly thought to be, but is dependent for its success on the factors mentioned.

In addition to the inefficiently performed operation, other factors concerned in the recurrence of tonsillar tissue are: the possibility of regrowth of lymphoid tissue even though the tonsil has been completely removed; proliferation of a lymph node in the fascia covering the tonsillar fossa; hypertrophy of the lymphoid tissue in one of the plicæ; and extension of the lingual tonsil into the lower pole of the fossa.

In the study of the tonsillectomized students herein reported it was observed that in those operated on by specialists there was considerably less scarring of the pillars, fossæ, and palate than in those who were operated on by general practitioners. This emphasizes again the fact that the well performed tonsillectomy is not a simple operation. Although mild injury of the faucial pillars usually produces no symptoms, more severe injury may cause considerable postoperative trouble. Destruction of the posterior pillar may interfere considerably with the function of the eustachian tube and the proper control of the throat in swallowing. It may also cause retractions of the soft palate, which may result in speech defects. Marked injury to the pillars and palate may result in considerable retraction or even atresia of the nasopharynx. Scarring in the tonsillar fossæ may also enclose tonsillar remnants which are often a greater menace to the patient both locally and generally than the original tonsils.

NOAH D. FABRICANT, M.D.

Lierle, D. M.: Epidermoid Carcinoma of the Pharynx, Buccal Mucosa, and Larynx. *Ann. Otol., Rhinol. & Laryngol.*, 1939, 48: 875.

The author presents a brief statistical report of 169 cases of epidermoid carcinoma involving the buccal mucosa, pharynx, and larynx. Except in a few instances, the cases were inoperable because of the extensiveness of the primary lesion, metastases, or the poor general condition of the patient. Consequently, for the most part, irradiation was the only treatment possible.

It is the author's opinion that for the present, the best results in localized and differentiated tumors without metastases may be obtained by surgical procedures, with or without irradiation. In this connection, it is only fair to say that better results with irradiation are achieved each year, so that this statement may not hold true in the future.

In general, the primary lesions in undifferentiated tumors responded well to treatment, but in most cases metastatic glands appeared which were not evident, but probably were present, at the time the primary growth was treated. In general, better results were obtained in older persons, and in well-differentiated tumors. Less differentiated lesions, as would be expected, were seen oftener in younger patients.

Advanced malignancies and undifferentiated tumors do not respond well to any treatment. Irradiation, the only treatment possible, is definitely of value. Months or years of life with freedom from symptoms may be obtained.

JOSEPH K. NARAT, M.D.

NECK

Elmer, A. W.: The Etiology and Pathogenesis of Thyrotoxicosis, with Special Reference to Its Pituitary Origin. *New England J. Med.*, 1939, 221: 927.

The author discusses the etiology and pathogenesis of thyrotoxicosis from the viewpoint of intrinsic and extrinsic factors.

The two theories concerning the intrinsic factors discussed are: the inability of the thyroid gland to retain its elaborated hormone, and the production of an altered secretion. The author is of the opinion that each of these theories is lacking in proof.

The following extrinsic factors are discussed: adrenal cortex, vitamins, sex glands, nervous system, anterior pituitary body, and the liver. It is known that the thyroid gland is subordinated in its activity to the anterior pituitary body and possibly indirectly or directly to the nervous system.

As to the rôle of the adrenal cortex, the author admits that the adrenal glands may suffer from pathological alterations in the course of thyrotoxicosis, and some of the symptoms, for example, lack of energy and muscle strength, may be due to the loss of endocrine activity of the adrenal cortex. In such cases the administration of cortin may be beneficial in abolishing the symptoms mentioned but never those of the thyrotoxicosis itself.

There may be a more or less marked deficiency of vitamins at the onset of thyrotoxicosis. The hypovitaminosis results either from increased consumption or reduced absorption. Therefore it is not surprising that the requirement of vitamins is increased in thyrotoxicosis. The author agrees with Means that vitamins, except perhaps Vitamin A, have no marked, if any, effect on the thyroid gland comparable with that of iodine.

There is no doubt that the normal relation between the ovaries and the thyroid gland is very important. This is indicated by the quite important iodine content of the ovaries, and by the influence of ovariotomy on the iodine content of the thyroid gland and the blood. Also, it is demonstrated by the changes in iodine metabolism which occur at different functional periods of the ovaries, such as during menstruation, pregnancy, and the menopause. The rôle of the ovaries is considered more important than that of the testicles since thyrotoxicosis is three to six times more frequent in women than in men.

Loeb in 1932 discovered the thyrotropic hormone and he evolved the hypothesis that the action of the anterior lobe of the pituitary body is involved in the etiology of thyrotoxicosis. He was able to produce in guinea pigs all of the principal symptoms of

Graves' disease (exophthalmic goiter). The animals developed a resistance to the thyrotropic hormone; this refractoriness did not appear if increasing doses of thyrotropic hormone were administered.

The author and his coworkers confirmed these findings by the injection of concentrated thyrotropic hormone in dogs and guinea pigs. The thyrotoxic signs that were constant were general weakness, nervousness, loss in weight, dehydration, polyuria, fever, marked heart symptoms, increased basal metabolic rate, hyperedema, increased iodine excretion in the urine, and hypocholesterolemia. The inconstant symptoms were nausea, vomiting, diarrhea, and eye signs. All of the dogs died during the injections or from seven to ten days after their cessation. There was marked liver damage. All of the thyroid glands appeared histologically to be hyperfunctioning. The anterior lobe of the pituitary gland was almost completely deprived of its acidophilic cells, which was interpreted by the author as atrophy of disuse.

The author's experiments with barbiturates along with thyrotropic hormone led him to believe that they limit rather than exclude a secretory function of the nervous system.

The liver is the organ that possesses the power to destroy the thyroid hormone. The author and one of his associates investigating this function of the liver conclude that this power of the liver is somewhat limited. Thus he concludes that in thyrotoxicosis with its concomitant liver damage this destruction of the thyroid hormone is still further slowed up. EARL O. LATIMER, M. D.

Lambie, C. G.: The Thyreotrophic Hormone and Its Relation to Clinical Syndromes. *Med. J. Australia*, 1939, 2: 819, 853.

It has long been considered probable that the pituitary gland exerts an important influence upon the thyroid in view of the secondary effects of pituitary lesions, whether these be associated with syndromes of deficiency or excess. Thus, in patients suffering from Simmonds's pituitary cachexia, in which condition extensive changes are present in the pituitary, the thyroid is found to be atrophied. Again, some pituitary tumors may be associated with clinical appearances suggestive of hypothyroidism; others, such as eosinophil adenoma, may be accompanied not only by acromegaly, but by signs of hyperthyroidism, and even exophthalmic goiter.

Experimentally, it has been shown that thyroid stimulation could be obtained independently of gonadotropic and growth effects, and that pituitary extracts could induce thyroid hyperplasia not only in amphibia but in mammals.

Aron was the first to demonstrate the effect of pituitary extracts upon the mammalian (guinea-pig) thyroid. The morphological changes in the thyroid following the administration of thyrotropic extracts may be referred to as "Aron's reaction," and are described in detail. The Aron reaction is the most useful and dependable method of detecting and measuring the thyrotropic activity of tissues and body fluids. Applying the Aron reaction, it has been found convenient to define the unit of activity as that amount of hormone which when injected daily for three days causes recognizable hypertrophy of the epithelium and disappearance of colloid in the thyroid glands of guinea pigs of from 100 to 150 gm. in weight.

The concentration of thyrotropic hormone in the pituitary gland varies in different animal species. In the human hypophysis wide variations in the content of thyrotropic hormone are encountered, independently of age, the highest values being obtained in tuberculosis and other infections. It is extremely doubtful whether thyrotropic hormone is present in appreciable amounts in the normal body fluids and tissues outside of the hypophysis.

The highly purified dried thyrotropic hormone appears as a white amorphous powder, readily soluble in water and dilute acids and alkalis, and in watery methyl and ethyl alcohol and acetone, especially in acid solution. It is insoluble in concentrated organic lipoid solvents, such as ether, absolute alcohol, chloroform, acetone, pyridine, and pentachlorethane. The hormone is precipitated by the salts of heavy metals and other protein precipitants, but the purer the preparation, the less readily is the hormone brought down by these precipitants.

Ultrafiltration, like precipitation with salicylsulfonic acid, removes the Aron-reaction-producing and metabolism-stimulating factors, while ultrafiltrates still contain the factors responsible for metamorphosis. The active principle is readily adsorbed by colloidal iron, especially in alkaline solution, and by animal charcoal. Kaolin is a somewhat less effective adsorbent. In the completely dry state the hormone is very stable, extracts retaining their potency almost unchanged for at least a year. On the other hand, in the presence of moisture or in watery solution (especially alkaline) the hormone activity rapidly deteriorates.

The available evidence points to the conclusion that the hormone, if not itself a protein, is at all events very closely bound to protein. If a protein, it has probably a relatively low molecular weight, as suggested by its diffusibility. Purified extracts give the protein color reactions, and the active principle is precipitated by protein precipitants.

The destruction of the hormone by proteolytic enzymes and its apparent antigenic properties also point to its being of protein nature. The hormone has not yet been obtained in a sufficiently pure state to enable a satisfactory element analysis to be made or to determine its empirical formula; but the purest preparations contain carbon, hydrogen, oxygen, nitrogen, and sulfur. It is apparently rich in oxidized sulfur, the sulfur content going parallel with physiological activity.

Probably because of its destruction by proteolytic enzymes, and possibly also because of imperfect absorption, the hormone is inactive when given by mouth; therefore, for purposes of physiological in-

vestigation, it has to be administered parenterally. There is every reason to believe that the action of the thyrotropic hormone on the thyroid is a direct one, independent of the central nervous system.

When thyrotropic hormone is administered continuously, it begins, after a few days, to lose certain of its effects—the animal becomes resistant to its action. This phenomenon is observed only in respect to the changes in the thyroid gland and the secondary effects dependent upon the thyroid; but it does not develop in relation to exophthalmos, nor does it affect adrenal hypertrophy. The morphological changes in the thyroid associated with increased activity of the gland, together with all the secondary changes dependent upon this hyperactivity, attain their maximum in the guinea pig and rat, as a rule, from the seventh to the twelfth day of administration; there is then a decline of all these toward the normal, which may be reached in from two to four weeks, and thereafter a subnormal phase associated with hyperinvolution of the thyroid may supervene.

Two factors appear to be involved in the etiology of resistance: (1) the appearance of neutralizing substances in the blood, and (2) the inhibitory effect of thyroid secretion upon the pituitary gland, that is to say, the endogenous regulation of hormone balance.

The neutralizing substances bear certain resemblances to antibodies. They are hormone specific, i.e., they neutralize only the thyrotropic hormone, and not, so far as is known, any of the other pituitary hormones, so that they appear not to be antibodies to the pituitary proteins apart from thyrotropic hormone. They are not, however, quite species specific, but, as is common in immunity reactions, they exhibit a good deal of group immunity.

The influence of the thyroid upon pituitary secretion is shown by the effects both of diminished and of increased thyroid secretion. Diminished thyroid secretion causes increased pituitary activity. Excision of the thyroid leads to hypertrophy of the pituitary. It has also been shown that compensatory hypertrophy of the thyroid remainder after removal of one-half of the thyroid depends upon the integrity of the pituitary gland.

Increased thyroid activity causes diminished pituitary secretion. Thus it has been found that the administration of thyroid extract or of thyroxin prevents pituitary hypertrophy in thyroidectomized animals, diminishes the content of the pituitary secretion in thyrotropic hormone, and inhibits the secretion of thyrotropic hormone.

There are two ways of overcoming or avoiding the development of resistance: by giving very large and increasing doses of thyrotropic hormone, and by breaking up the "hormone-antigen complex" by the use of flavianic acid. The hormone flavianate is said to cause thyroid hypertrophy, but not to excite the development of resistance.

It is apparent that a strong similarity exists between the changes induced by the thyrotropic hormone in the laboratory animal and hyperthyroidism and Graves's disease in man. This resemblance extends even to the occurrence of acute and fatal thyrotoxicosis similar to the thyroid crises of the human disease. The morphological changes in the thyroid gland, both microscopic and macroscopic, resulting from the administration of thyrotropic hormone, bear a striking resemblance to those found in primary Graves's disease (diffuse parenchymatous toxic goiter).

The experimental analysis of the nature of the stimulus to the thyroid has some bearing upon human pathology, in that it supports the view that the ultimate stimulus to the gland is a chemical and not a nervous one. This does not exclude the possibility that nervous stimuli associated with emotional reactions may proceed from the hypothalamus to the pituitary gland, giving rise to an increased secretion of thyrotropic hormone, which in turn would lead to thyroid hyperplasia and ultimately to thyrotoxicosis. Although experimental work on thyrotropic hormone has failed to throw any light upon the primary cause of the disorder of glandular secretion in man, it has helped to elucidate the mechanism of thyrotoxicosis.

The parallelism between human and experimental thyrotoxicosis can be demonstrated with respect to all the changes which can be referred to increased thyroid activity: rise of blood iodine, basal metabolism, and temperature; loss of weight; changes in the heart and circulation, the nervous system, the skin, and in carbohydrate, protein, water, salt, and mineral metabolism. The relationship between thyrotoxicosis and exophthalmos, however, presents certain difficulties, since exophthalmos in the experimental disease can be produced independently of the thyroid gland.

There appear to be two factors involved in the mechanism of exophthalmos: the stimulation of the sympathetic system and the increase in retrobulbar fat. The first of these is seen after administration of sympathomimetic drugs, and the effect is abolished after section of the cervical sympathetic. Stimulation of the sympathetic is responsible for the retraction of the upper lid owing to the contraction of the smooth muscle fibers (Mueller's muscle) in the levator palpebræ superioris, which are supplied by the sympathetic. Sympathetic hypertonus may be a cause of exophthalmos during the early phases of the action of thyrotropic hormone.

The second factor in the production of exophthalmos is the accumulation of retrobulbar fat, which has been found to be under increased tension, as it bulges when incised. It, therefore, seems probable that the growth of fat in this situation creates a positive pressure, and that this rise in intra-orbital tension is the direct cause of proptosis in the later stages of the evolution of exophthalmos.

The changes occurring in exophthalmic ophthalmoplegia in man are paralleled by those which occur in the guinea pig treated with thyrotropic hormone or, more precisely, with thyrotropic pituitary extracts.

Exophthalmos, therefore, may be supposed to result from the action of thyrotropic hormone through the operation of two mechanisms; (a) secondary hyperthyroidism with associated sympathetic hypertonus; and (b) a direct action upon the retrobulbar tissues leading to the accumulation of fat and the raising of retrobulbar tension. It is possible however, that this second action may be due not to thyrotropic hormone, but to some closely related factor present in pituitary extracts.

One of the most serious objections to the assumption that exophthalmos in Graves's disease is due to hypersecretion of thyrotropic hormone is the fact that there is no evidence of the presence of excess of this hormone in the blood or urine of patients suffering from exophthalmic goiter. This does not, however, necessarily prove that in Graves's disease there is no excessive secretion of thyrotropic hormone, for although thyrotropic hormone is stable in serum *in vitro* and can be readily recovered from serum when added to it outside the body, it rapidly disappears from the blood *in vivo*.

Another possible cause of Graves's disease is a deficiency of neutralizing substances in the blood; but the physiological results of the unbalanced action of the thyrotropic hormone would be similar to those of excessive secretion of the hormone.

Formerly it was generally assumed that thyrotoxicosis was essentially a primary disorder of the thyroid. The possibility of the existence of varieties of thyrotoxicosis, in which the primary seat of the disease is outside of the thyroid must be recognized, however.

The varieties of thyrotoxicosis may be classified tentatively according to the probable primary seat of the disorder as follows:

A. Primary thyrotoxicosis, i.e., thyrotoxicosis primarily of thyroid origin.

B. Secondary thyrotoxicosis, of which three subvarieties may be recognized:

1. Of pituitary origin—thyrotropic hormone excess.
2. Due to deficiency of antithyrotropic principle.
3. Of endocrine origin other than pituitary.

The normal activity of the thyroid is dependent upon pituitary secretion. Experimental ablation or destruction of the pituitary gland leads to physiological and morphological involution and atrophy of the thyroid. The possibility, therefore, exists that certain varieties of hypothyroidism may be due to deficiency of thyrotropic hormone.

In the majority of cases, if not in all, myxedema appears to be an expression of primary thyroid disease; but the possibility cannot be excluded that it may occasionally result from pituitary disease. Something more than a diminution in secretion is necessary for the production of myxedema. The additional factor may be some qualitative change in the character of the thyroid secretion due to degenerative changes in the thyroid.

If the effects of insufficiency of thyrotropic hormone are due merely to the secondary failure of thyroid secretion, it is obvious that the simplest method of treatment will be to replace the deficiency by the administration of thyroid. The administration of thyroid, however, does not promote the recovery of thyroid function, and some cases of secondary hypothyroidism may be resistant to thyroid. On the other hand, thyrotropic hormone would provide the physiological stimulus to the thyroid gland and its effect might prove to be more lasting.

The hormone solution is injected intramuscularly, the dose for the human subject varying from 400 to 2,000 units daily. An average dose would be approximately 1,000 units daily; but it has been found that 2,100 units a week, divided into three doses of 700 units, are quite effective in raising the basal metabolic rate in some cases.

The mechanism of resistance suggests that the physiological remedy for excessive secretion of thyrotropic hormone would be the administration of the neutralizing substances which appear in the blood of refractory animals.

A concentrated extract containing the protective, neutralizing substances from normal sheep's blood, when injected into the peritoneal cavity, protects guinea pigs against the effects of thyrotropic hormone.

The anti-thyrotropic action of ascorbic acid, found in relatively large quantities in the pituitary and adrenal glands, was tested in the usual way against a known dose of thyrotropic hormone in the guinea pig, both substances being injected intraperitoneally. It was found that ascorbic acid possessed some protective action, but subsequent investigation showed that this was feeble when compared with that of the neutralizing substances found in the blood, as only massive doses were effective.

Some relationship exists between the ascorbic-acid content of the tissues and the secretion of thyrotropic hormone. It was found that the administration of thyrotropic hormone caused a fall in the ascorbic content of the adrenals and a rise in that of the liver, the effect being most marked in the first twelve days of treatment, while during the recovery period the ascorbic-acid content of the adrenals rose above the normal level. It is probable that this action of thyrotropic hormone is mediated through the thyroid gland, as thyroxin has been shown to cause a diminution in the amount of Vitamin C in the adrenals.

Iodine, inorganic iodide, and di-iodotyrosine are all capable of bringing about a remission in exophthalmic goiter, and they have also been found experimentally to prevent or to diminish the rise in respiratory metabolism induced by thyrotropic hormone as well as the morphological changes in the thyroid. Although thyroxin and thyroxin-O-methylether, on account of their stimulating action upon the metabolism, are not likely to be of therapeutic value in thyrotoxicosis, it is of interest to note that they, too, inhibit thyroid hyperplasia following the administration of thyrotropic hormone. Two facts seem

to point to the involvement of the hypophysis in the inhibitory action of iodide and its compounds: (1) the diminution of the thyrotropic-hormone content of the hypophysis following the administration of iodine, thyroxin, di-iodothyronine and di-iodotyrosine; and (2) the observation that while iodine diminishes the effect of a given dose of thyrotropic hormone upon the morphological changes in the thyroid and upon the pituitary metabolism, the action fails in hypophysectomized animals.

The available evidence points to a two-fold action of iodine compounds, namely, a decrease of the secretion of thyrotropic hormone by the pituitary, and a modification of the response of the thyroid gland to thyrotropic hormone.

SAMUEL KAHN, M.D.

Beck, A. L.: Deep Neck Infection. *Ann. Otol., Rhinol. & Laryngol.*, 1939, 48: 940.

In a clinical study of 78 cases of deep neck infection occurring in patients from eight months to eighty-one years of age, it was found that the streptococcus hemolyticus appeared in pure culture more often than any other organism (40 per cent), and that some form of streptococcus was present in more than 80 per cent of all the infections. The tonsils and pharynx were the most common portals of entry (53 cases); infection following the extraction of teeth (10 cases) was the next most common finding. Other portals of entrance developed following tonsil and adenoid operations and also dental infections unprovoked by extraction. When unchecked, neck infections go on to a fatal termination because of septicemia, asphyxiation, or hemorrhage. The symptomatology of neck infections varies greatly according to the location of the inflammatory process and also the intensity of the infection. The recognition of sepsis is of the utmost importance. A positive blood culture is of course conclusive.

Localization of the infection may be recognized by spasm or splinting of the muscles at the site of the inflammatory reaction; pain due to sensory-nerve involvement; paralysis due to motor-nerve involvement; and disturbances in the function of the larynx and pharynx. The pharyngomaxillary space is most commonly involved. There were 47 patients with involvement of this space. The carotid sheath and its contents are located in the retrostyloid compartment of this space and may become involved. This occurred in 9 instances with 1 death. In another instance a carotid-sheath infection followed a deep cervical adenitis. When infection of the blood stream and jugular thrombosis are suspected or known to exist, the fundi should be frequently examined for choked disc and retinal thrombosis. After cavernous-sinus thrombosis has actually taken place the outlook is hopeless. Choked discs do not always signify cavernous-sinus thrombosis but they indicate serious embarrassment of the intracranial circulation. Unless transient, serious loss of vision from optic nerve atrophy will result (1 case). Actual thrombosis of the internal jugular vein is not always present even when the vein walls are involved (1 case). Extension of infection about the parotid and submaxillary fossæ may occur. In this series there were 9 instances. A direct approach to an abscess in the pharyngomaxillary space may be made through the posterior pillar after removal of the tonsil. In those cases having only a mild sepsis this is a justifiable procedure and will frequently avoid external neck drainage. With severe sepsis external drainage should be done. An abortive type of pharyngomaxillary infection may occur in which the organism is the hemolytic streptococcus and the patient has been given sulfanilamide. Submaxillary and parotid-space infection often follows dental, tonsillar, or pharyngeal infection. There is usually considerable swelling of the floor of the mouth, and edema of the larynx occurs frequently. There were 16 instances of such infections.

Infection behind the pretracheal fascia is serious and may arise from injury to the pharynx, such as the swallowing of foreign bodies or the spread of infection from adjacent spaces. The dangers are edema of the larynx, mediastinitis, and pulmonary and blood-stream infections. There were 8 instances of this type of infection. Four followed pharyngomaxillary infection, and 2 deaths occurred. Prevertebral-fascia infection is exemplified by the midline retropharyngeal abscess. These abscesses tend to gravitate into the posterior mediastinum. There were 4 cases in this group. Peroral incision made before respiratory embarrassment has occurred usually results in prompt and permanent recovery. Lymph-gland involvement occurred most often as a secondary complication in 45 of the 78 cases. Anesthesia is always a serious problem. Dyspnea contraindicates general anesthesia. If a breathing tube cannot be inserted, tracheotomy is necessary.

In the absence of dyspnea intrapharyngeal anesthesia is used. Nitrous-oxide-oxygen, cyclopropane, avertin, and ether in various combinations are the author's preference.

MANUEL E. LICHTENSTEIN, M.D.

Hall, C.: Sepsis Following Pharyngeal Infections. *Ann. Otol., Rhinol. & Laryngol.*, 1939, 48: 905.

Severe sepsis is not an uncommon complication or sequel of pharyngeal infections, the true nature of which is too frequently recognized only post mortem. This article is concerned with general sepsis which has its origin in the pharynx or the pharyngomaxillary space, its extension by way of the internal jugular vein and tributaries, and its local signs often of very meager proportions. For the successful treatment of such an entity it is essential to obtain a careful history of the case and to possess a thorough knowledge of the anatomy and pathology of this region.

There are three routes by which infection may reach the general circulation from the pharynx: phlebitic, phlegmonous, and lymphatic. Only one or a combination of these may be involved in the individual case. When the phlebitic route is involved,

the internal jugular vein receives blood from the pharyngeal and tonsillar plexus, usually by way of the common facial vein, although occasionally the anterior facial, the posterior facial, and a few small pharyngeal veins may empty independently into the internal jugular vein. A thrombophlebitic process arising in the small veins of the pharynx reaches the general circulation by the same route and, in addition, after reaching the internal jugular vein, may involve the lateral sinus by retrograde extension.

In considering the phlegmonous route, one is mainly concerned with the pharyngomaxillary space. The pharyngomaxillary space is a potential space separated from the tonsil, the pharynx, and peritonsillar space only by the constrictor muscle and its fascial coverings. It becomes actual only when made so by disease, by the anatomist, or by surgical exploration. The pharyngomaxillary space is not infrequently the site of phlegmonous processes which may or may not eventuate in suppuration, and the internal jugular vein may become involved in a periphlebitic or thrombophlebitic invasion. Arterial erosion and subsequent hemorrhage in pharyngomaxillary phlegmon is an uncommon but extremely dangerous complication. The signs of pharyngomaxillary phlegmon are: extreme trismus, induration and swelling over the parotid gland extending to below the angle of the jaw, obliteration of the "subangular space" beneath the angle of the jaw, and peritonsillar swelling and induration with little or no pharyngeal inflammation. Fluctuation occurs dangerously late, if at all.

The lymphatic route involving the perijugular lymphatics has received much attention in the literature. Clinically there are two ways in which the infection may spread: in one the sepsis immediately follows the pharyngeal infection, and in the other the pharyngeal infection has subsided for from several days to several weeks, only then to be followed by severe sepsis. Either type may be phlebitic or phlegmonous. In the phlegmonous type involving the peritonsillar or the pharyngomaxillary space, the diagnosis should present no difficulty. However, in the purely phlebitic type the pharyngeal signs are frequently so slight as to cause the fatal overlooking of the source of the sepsis. In these cases it is essential immediately to rule out pyelitis, other pyemic foci, the possibilities of erysipelas, endocarditis, blood dyscrasias, and true pneumonia, and then be prepared to open the neck immediately.

The leucocytic count varies, but in the more severe cases it ranges from 20,000 to 50,000, or even higher. The red cells and the hemoglobin tend to decrease as the disease progresses. Blood cultures are significant when positive. The prognosis of the thrombophlebitic cases depends upon the offending organism and the duration of the disease before rational therapy is instituted. In the cases due to the hemolytic streptococcus, and possibly the pneumococcus, the prognosis is better than when the invading organism is anaerobic, a staphylococcus, or the streptococcus viridans. The organisms of this latter group are more dangerous because of the metastatic abscesses which they form. In the cases infected with the hemolytic streptococcus, repeated chills may occur without severe damage, and even late ligation may save the patient. In the cases in which an anaerobic organism, the staphylococcus, or the streptococcus viridans is the invading organisms, each successive chill signifies a more grave prognosis. In this type the initial chill would be the indication for immediate surgical intervention. Early surgery followed by intensive chemotherapy is imperative in this group.

The prime requisites of treatment are: to control the primary focus, to cut off the primary focus from the general circulation, and to combat the metastatic foci. To control the primary focus it is necessary to establish surgical drainage and/or institute chemotherapy. To cut off the primary focus from the general circulation one must ligate the common facial vein, the internal jugular vein, or both. Ligation of the internal jugular must be made both above and below the entrance of the common facial vein, and beyond the area of the phlebitic process. A diseased vein should be resected, while resection of a grossly normal vein perhaps is optional. To combat the metastatic foci reliance must be placed upon chemotherapy and general supportive measures.

In a case of peritonsillar or pharyngomaxillary suppuration in which chills or septic temperatures occur or persist after adequate drainage, or after subsidence of the inflammation, venous ligation should be done. In a pharyngomaxillary phlegmon not responding to chemotherapy in forty-eight hours and accompanied by sepsis, external drainage of the pharyngomaxillary space and possibly venous ligation should be done. Any active or subsiding pharyngeal infection accompanied by sepsis should be suspected of being a thrombophlebitis, and this diagnosis should be proved or ruled out immediately. In case of doubt the carotid sheath and its contents should be investigated. Experience has shown that hours are precious in this condition, and procrastination in instituting rational therapy is an invitation to a fatality.

When the common facial or the internal jugular vein is grossly diseased, both veins should be ligated. In case of doubt in a severe case, and when the veins appear normal, ligation should be done. In any case in which the neck is opened the surgeon should investigate both the carotid sheath and the pharyngomaxillary space. Clinical and pathological variations are demonstrated by Hall in a series of 8 case reports. NOAH D. FABRICANT, M.D.

Iglauer, S., and Molt, W. F.: Severe Injury to the Larynx Resulting from the Indwelling Duodenal Tube. *Ann. Otol., Rhinol. & Laryngol.*, 1939, 48: 886.

At the present time the indwelling duodenal tube is in common use, either as a conveyor of food or drugs in patients who are unable or unwilling to swallow, or postoperatively as a siphon in the

prophylaxis and treatment of gastric and intestinal distention. The postoperative use of the duodenal tube for the prophylaxis and treatment of distention has proved to be a great boon to both the patient and the surgeon. While it is true that in the vast majority of instances the indwelling tube causes no damage and can be retained for prolonged periods, nevertheless the authors have found that a severe injury to the larynx is occasionally excited by the presence of the tube and that this complication may occur after a comparatively brief sojourn of the tube. During a two-year period, 10 such cases have been observed. Eight patients developed laryngeal stenosis of such severity that tracheotomy became imperative, while 2 came to autopsy.

Nine of the 10 cases of laryngeal stenosis occurred in patients who had worn an indwelling duodenal tube after laparotomy. The tube was inlying for comparatively short periods varying from six to twenty days. The average period was eight and a half days. In most instances the signs of laryngeal involvement were first recognized, or became manifest, after the permanent removal of the duodenal tube. The early symptoms of laryngeal or esophageal injury included pain, dysphagia, blood-streaked sputum, hoarseness, and a croupy cough, accompanied by more or less dyspnea. These symptoms gradually increased in severity over a period of days or weeks when dyspnea became the predominating symptom and was so extreme that tracheotomy became imperative in all but 2 of the 10 patients. Laryngeal examination in the acute stage revealed evidence of inflammation and edema. Subglottic edema usually accounted for the extreme dyspnea. In the later cases, when the patients presented themselves permanently cannulated with tracheotomy tubes, various degrees of fixation of the arytenoid articulation, together with firm, fibrous, subglottic stenosis, were the predominating findings.

In 2 patients there was a complete subglottic occlusion. Five patients were still under treatment for laryngeal stenosis, and none of these has been able to dispense with the tracheal cannula. Two patients refused treatment; 2 others came to autopsy. In 1 patient there was deep ulceration of the upper end of the esophagus, with perichondritis over the posterior aspect of the cricoid cartilage and extension of the inflammatory process into the lumen of the larynx. In another there were shallow linear ulcers in the upper end of the esophagus in the cricoid region. These were associated with marked intralaryngeal inflammation.

From a study of these cases it is deduced that the laryngeal inflammation was secondary to the presence of an indwelling duodenal tube. The primary lesion appeared to be due to pressure necrosis of the esophagus at its attachment to the bodv of the cricoid cartilage, for in this area the muscular coat of the esophagus is very thin and does not provide much of a cushion between the mucous membrane and the cartilage. Further, the constant pressure of the sphincter muscles on the duodenal tube would tend to force the latter against the cricoid cartilage, and this pressure, together with friction, might lead to ulceration of the mucous membrane over the lamina of the cricoid. Finally, there may be pinchcock mechanism with pressure between the cricoid cartilage and vertebral column. If the ulceration extended to the deeper structures, perichondritis on the posterior aspect of the cricoid cartilage would ensue. From this area, the perichondritis could easily spread over the upper border of the cricoid cartilage into its internal perichondrium, and give rise to acute subglottic stenosis of the larynx, or to arytenoid fixation. The acute stage is followed by fibrosis with cicatricial stenosis of the larynx, similar to the effects of perichondritis arising from other causes.

NOAH D. FABRICANT, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Heinbecker, P., and White, H. L.: The Rôle of the Pituitary Gland in Water Balance. *Ann. Surg.*, 1939, 110: 1037.

As the title of the paper suggests, carefully planned animal experiments were undertaken to determine the rôle of the pituitary gland in water balance.

There have long been two schools of thought in this connection; that of the "hypothalamists," who believe that the hypothalmus is primarily involved in diabetes insipidus; and that of the "hypophysists," who attribute diabetes insipidus to the loss of all or part of the pituitary gland.

Ransom and his coworkers had shown that permanent polyuria followed lesions of the hypothalamus, provided the hypothalamicohypophyseal tracts were interrupted.

The authors of this paper attacked the hypothalamicohypophyseal tracts by: (1) high stalk sections, with or without removal of the glandular hypophysis; (2) low stalk sections, with or without the removal of the glandular hypophysis; and (3) total destruction and removal of the neural hypophysis with removal of the glandular hypophysis. These experiments were carried out on 100 dogs. The positions of the lesions are carefully described.

The authors were able to come to certain significant conclusions:

Diabetes insipidus results only after complete removal of all the neural hypophysis, i.e., the posterior lobe, the infundibulum, and the tuber cinereum. The anterior lobe of the pituitary gland normally plays a diuretic rôle; the anterior lobe and the thyroid appear to be synergistic.

The article contains a short note on human diabetes insipidus. In a fifty-five-year-old colored male with syphilis of the central nervous system and diabetes insipidus, who did not respond to anti-luetic treatment, a complete thyroidectomy was said to have been done. Following this there was a decrease in the urine output of from 25 to 30 per cent on a normal diet with unrestricted salt intake.

ADRIEN VERBRUGGHEN, M.D.

Gellerstedt, N., and Lundquist, R.: Cushing's Disease Without Basophile Adenoma. The Significance of the So-Called Hyaline Change of the Basophile Cells (Zur Frage des Morbus Cushing ohne basophiles Adenom. Die Bedeutung der sog. hyalinen Veraenderung der basophilen Zellen). *Upsala Läkaref. Förh.*, 1939–1940, 45: 233.

In contrast with Cushing's primary conception of the pathogenetic importance of the basophile adenoma of the anterior pituitary lobe for the clinical picture of Cushing's disease, evidence accumulates that not rarely basophile adenomas cannot be found in such cases, even with series sectioning. From the adrenal changes, the theory of secondary interrenalism has been advanced (Cushing, Bauer). Forconi, Horneck, and others believe in a pluriglandular disturbance, perhaps with predomination of the hypophysis, while again others (Kraus, Kalbfleisch *et al.*) assume primary nervous disturbances. Crooke, Hare, and Ross described a specific change of the basophile cells in a typical case of Cushing's disease in 1935: a "hyaline change" (Crooke) ("hyaloid" would appear preferable to the authors) which seems to be not of a degenerative nature, and which may be the only histological abnormality, or may accompany the basophile adenoma, but does not occur within the adenomatous portion itself. This change occurs almost exclusively in Cushing's disease.

The fact that numerous observers failed to see these changes may be due to the difficulty of obtaining the characteristic picture with the usual staining method: a little too strong eosine staining, or a predominance of the hematoxyline color may render them undiagnosable.

Gellerstedt and Lundquist (Pathologic Institute, University of Upsala, and First Medical Department, Sahlgren Hospital, Gothenburg, respectively) discuss these problems in reference to the following 2 cases of Cushing's disease without basophile adenoma.

Case I. A man, aged twenty-seven, was admitted to the hospital in March, 1936. He complained of lumbago-like pains, and reported increasing obesity (especially of the face), dryness of the skin, loss of sexual power, thirst and polyuria, occasional spells of vertigo, and increasing mental dullness. Examination showed: true ozena, blood pressure 210/160 mm. Hg, a daily urine output of 2 to 4 liters, and moderate secondary anemia; the general examination was otherwise negative. The sugar-tolerance test showed: fasting 150 mgm./100 c.cm. One and one-half hours after 1 gm. dextrose per kgm. of body weight in 10 per cent aqueous solution was administered the peak was 250 mgm./100 c.cm., and after three hours the test showed 130 mgm./100 c.cm., with glycosuria during the high blood-sugar period. X-ray examination showed decalcification of the lumbar vertebræ. The patient had a typical full-moon face, and there was the characteristic fat accumulation around the neck and trunk. Treatment consisted of the oral administration of calcium and x-ray irradiation of the pituitary gland. The psychic picture became worse. The decalcification increased within some weeks, the patient became irritable and presented other emotional disturbances. Death occurred under the sign of a failing circulation in December, 1936. The post-mortem examination showed simple hypertrophy of the heart, and various and insignificant findings in the other organs; in the hypophysis which was sectioned horizontally in a

continuous series no basophile adenoma was found. There was a slight reduction of the eosinophiles with a slight increase of the chief cells, and very many basophiles with Crooke's hyaline change were noted.

Case II. A woman of forty-six noticed increasing fat deposits in the face and neck two years before admission; vertigo spells, abnormal hair on the temples, chin, and upper lip, loss of vigor, impairment of memory more recently; and hypertony for the last few months. Examination affirmed these complaints, and showed a blood pressure of 215/120. Furthermore, diabetes mellitus was found, but the rest of the physical and laboratory examination was negative. Two and one-half months after admission to a psychiatric institution, she suddenly collapsed and died. On post-mortem examination, the hypophysis appeared normal macroscopically. The left adrenal gland was small. Between the right kidney and the liver there was a tumor of the size of a baby's head, which microscopically was diagnosed as a carcinoma of the adrenal cortex. Liver metastases were present, and of the same structure. The histological examination of the hypophysis, done with the same technique as that used in the preceding case, resulted in almost exactly the same findings.

On the ground of detailed histological studies, Gellerstedt insists that Crooke's hyaline change is not identical with the tannic-acid fast cells of Kraus; Kraus (1937) had doubted the significance of Crooke's findings and claimed their identity with what he himself had described in 1914 as tannic-acid fast cells.

As to the significance of the hyaline change of the basophiles in the morbid anatomy of Cushing's disease, Gellerstedt points out that all the pathological changes described so far (basophile adenoma, adrenal-cortex adenoma, thymus tumor, arrhenoblastoma) are insignificant because they may be found also without the clinical picture of Cushing's disease, while the hyaline change of the basophiles in considerable extent is found only in cases of Cushing's disease. He concludes that none of the mentioned changes is of dominant importance in the pathogenesis of this disease, except the hyaline change of Crooke.

The changes found in other endocrine organs in cases of Cushing's disease probably are due to the primary hypophyseal (hyaloid) changes, as the pituitary gland seems to have a dominant rôle in the endocrine system as a whole.

While Crooke has found that the hyaline change in cases of Cushing's disease with basophile adenoma does not occur in the adenoma itself, Gellerstedt reports a case of a man of forty-nine with typical Cushing's disease, basophile adenoma, and hyaline change, in whom, however, the hyaline change also occurred within the adenoma, and he believes in some kind of "secondary infection" of the adenoma with the hyaline change which originated outside of the adenoma. The apparently beneficial results of denervation or resection of the adrenal glands in Cushing's disease do not prove that the origin of the disturbance is adrenal, as these operations may just alter the response of the adrenal glands to the governing influences of the pituitary gland.

Gellerstedt believes that the hyaline change of Crooke, probably the leading morphological substrate in Cushing's disease, is the expression, not of simple hyperfunction, but of a real dysfunction in the involved parts of the hypophysis. In analogy to Graves' disease, he conceives of Cushing's disease as a hypophyseotoxicosis. In analogy to the formes frustes of thyrotoxicosis ("Basedowoid") he speaks of a cushingoid habitus, found not rarely in women during involution. This cushingoid habitus is supposed to be a simple hyperfunction, not a dysfunction, of the pituitary gland. Cushing's disease, according to this reasoning, would be understood as dysbasophilism or dysclimacterium precox.

HEINRICH LAMM, M.D.

SPINAL CORD AND ITS COVERINGS

Stender, A.: Operative Treatment of Spinal Arachnitis (Zur Frage der operativen Behandlung der Arachnitis spinalis). *Zentralbl. f. Neurochir.*, 1939, 4: 214.

Spinal arachnitis, which is now gradually being recognized more frequently, is classified as a primary and a secondary condition. The primary follows the original infectious process after a shorter or longer interval. The secondary is a sequel of organic spinal disease (syphilis, tabes, multiple sclerosis, syringomyelia, spinal tumors). Stookey's opinion that there can be no inflammatory reaction of the arachnoid because of the paucity of vascular structures cannot be upheld any longer. However, traumatic arachnitis is still an unusual occurrence. This corresponds with war experiences. It is assumed that a preexisting but not recognized arachnitis is aggravated by an accident or another injury. The author reports 6 cases of his own at the Foerster Clinic, which were very unusual in some respects. This report must be read in his original paper. The onset of the condition is usually a very gradual one. In the second, fourth, and fifth cases, for some inexplicable reason, the onset was very sudden. Without any warning the 3 patients suffered most excruciating pains in the os sacrum and especially in the thigh. These pains were rapidly followed by paresthesias and bladder complications. The condition in the first and second patients was of the usual type. In the first patient there were neuralgia-like pains, occasionally of intermittent character, such as we associate with arachnoidal cysts. One such cyst was found to encircle the right II cervical root. In the second patient there was a widespreading process with a firm-walled circumscribed cyst which caused compression of the marrow. The third patient suffered a severe developmental malformation of the bony pelvis with a twisting of the sacrum and the lumbar vertebra which, undoubtedly, caused tension of the caudal roots, and especially of the soft spinal meninges. An accident suffered two years previously could

hardly have been the sole cause of the condition. In the fourth and fifth cases a peculiar narrowing of the spinal canal was found, which may have resulted from the development of the arachnoidal tomentum. In the sixth patient also the onset was acute. After heavy work in his garden, this patient became ill and complained of constricting pains in the chest and abdomen with elevation of the temperature. Perhaps he had a bronchitic stasis with infection on a preexisting bronchiectasis.

In Stender's cases it was substantiated that a characteristic finding as to the cerebrospinal fluid was absent. In the presence of xanthochromia the cerebrospinal fluid was also found to be normal. On the other hand the myelogram was always of value, though occasionally it did not show the exact site of the lesion.

The operative results of the author's cases, as well as those in the 8 earlier cases operated upon in the Foerster Clinic, were as follows:

Of the 14 cases 5 were treated successfully in that relatively normal conditions were restored, i.e., the patients could do their usual work either completely or with limitations. There was improvement in 4 cases. Naturally, recurrences must be considered in a sickness of this character. One patient died of bowel obstruction following the operation.

Accordingly, if a localized cyst is present, one should operate. Even if there is an interruption in a section of the spinal cord and a nerve root lesion, in short, if there are symptoms of diffuse expansion of the processes, the surgeon should not hesitate. By excision of the main focus, even in such cases, a favorable outcome of the operation may be obtained, as the results here reported prove.

(Franz). Mathias J. Seifert, M.D.

PERIPHERAL NERVES

Falcone, R.: Delayed Nerve Suture (Zur spaeten Naht der Nerven). *Ber. 8. internat. Kongr. f. Unfallmed. u. Berufskrankh.*, 1939, 2: 496.

The author discusses several operations performed more than a year following injury, in which favorable results were obtained, even after an interval of eighteen months. Without denying or underestimating the value of immediate operation, the author feels justified in stating that one need not despair of attempting nerve suture long after injury under favorable circumstances. These circumstances, of course, must be determined by the "feel" and experience of the surgeon. The author emphasizes that this procedure is warranted especially because as a rule the operation involved is harmless. His first conclusion leads to the advice to operate more frequently than is customary today, and not, as is often done, to regard the cases which are a year or more old as incurable. The second conclusion concerns the favorable conditions for rapid intervention and demonstrates the necessity for proceeding promptly.

It often occurs nowadays, when an injured person refuses operation after all medical methods of treatment have been exhausted, that one must resort to decisive legal intervention. However, much valuable time is lost, all to the disadvantage of the operative results. There are many cases in traumatic surgery in which the need for prompt intervention is felt in the interest of the hospital and of the individual himself; but this need will never be so undeniable or urgent as in nerve operations.

The author thus expresses the belief that even when the legal proceedings suffer the prolongation of various appeals and enlistment of patronage and of law, they still might be reasonably shortened in the interest of the patient. Only through abbreviated procedures, emphasizes the author, will it be possible to attain curative results corresponding to the purposes of the legislator without frustrating the spirit of the law by casual motives.

(Galletto). O. Theodore Roberg, Jr., M.D.

SYMPATHETIC NERVES

Simmons, H. T., and Sheehan, D.: The Cause of Relapse Following Sympathectomy of the Arm. *Brit. J. Surg.*, 1939, 27: 234.

Impressed by the fact that relapse to the preoperative state occurs more frequently after sympathectomy for Raynaud's disease in the upper extremity than it does in the lower extremity, Simmons and Sheehan reviewed 38 casés of ganglionectomy and 29 cases of preganglionic section of the thoracic cord from Telford's Clinic. They describe 2 types of relapse: (1) *early* relapse, which occurs within a few days after operation, and is due probably to a local fault in the blood vessels of the fingers, and (2) *late* relapse, which occurs gradually after a period of several months, during which the patient has been free of symptoms.

The authors disagree with White in his belief that such late relapses are due to a hypersensitivity of the denervated blood vessels to adrenaline, because they have shown that such sensitivity diminishes with time, and it may be entirely absent when clinical relapse has unquestionably taken place. They have shown that every one of their cases of late relapse has undergone a regeneration of the vasoconstrictor fibers. They have also shown that clinical relapse becomes steadily worse as such regeneration progresses, and that with such progressive regeneration there is a predictable increase in vasodilatation by anesthetization of the ulnar nerve. They concede, however, that late relapse may be due also to a chronically progressive local change in the digital vessels.

They agree with Smithwick, Freeman, and White that following preganglionic section the hypersensitivity of the blood vessels to circulating adrenaline is less than after postganglionic excision, but they found that such hypersensitivity decreased with time after *both* operations. Regeneration of vasoconstrictor sympathetic fibers may occur after ganglionectomy as well as after preganglionic section, but it is less likely to do so, and, in any event, it

does so more slowly than when only the preganglionic fibers are divided. JOHN MARTIN, M.D.

MISCELLANEOUS

Davis, L., and Barker, M. H.: Clinical and Experimental Experiences in the Surgical Treatment of Hypertension. *Ann. Surg.*, 1939, 110: 1016.

It is the obvious belief of the two authors of this article that the proper approach to the problem of hypertension is by means of clinical and experimental investigations, each carefully controlled, and each on a small enough scale to make practical a detailed study of each patient and experimental animal. They would put more faith in the results of a small series of cases, carefully studied as individual clinical experiments, than on the mass results of a large number of patients treated either medically or surgically.

They have found that in treating patients classified as "essential" hypertensives, about half of them respond quite satisfactorily to potassium sulfocyanate therapy, while the other half remain "cyanate resistant" either because of an unusually rapid clearance of the drug or because of a maintenance of pressure for some unknown reason even in the presence of massive blood levels of the drug. It is for this other half, the cyanate-resistant patients, that they have considered the possible advantages of surgical therapy. All such patients receiving surgical treatment have a severe essential hypertension of 200 mm. Hg. or more systolic, and 100 mm. Hg. or more diastolic. There was no evidence of chronic glomerular disease, no marked peripheral arterial sclerosis, and the pressures were not "frozen" at some definite level. All have been given a long trial (up to three years) with cyanate therapy. Renal-function tests, detailed blood-chemistry studies, blood-pressure readings under various conditions, and the cold-pressor, nitroglycerine, and carbon-dioxide tests were all repeated over a sufficiently long time to assure a thorough acquaintance with the patient's disease status. The operation consisted of resection of a bilateral supradiaphragmatic sympathetic chain and of the splanchnic nerve.

With the aid of several case reports, it is pointed out that some cyanate-resistant patients have been made "cyanate sensitive" by splanchnectomy; that is, better pressure levels with less intensive cyanate dosage have been attained. This is an observation of considerable importance, but the mode of production of this desirable response remains unexplained. Hypertensive dogs, prepared with Goldblatt clamps, responded to cyanates before sympathectomy, and when freed of the drug responded to sympathectomy with a fall in pressure followed by a slow rise to their original hypertensive state. Such hypertensive, splanchnectomized dogs then again responded to cyanates, but the authors cannot definitely say that such animals were rendered more sensitive to cyanates by the operation. The authors are attempting to produce long-term hypertensive animals which are resistant to cyanates, in order to correlate more closely the clinical and experimental results. Meanwhile, throughout their studies, they are alert to the possible discovery of the mode or site of action of the cyanates in hypertensive patients. JOHN MARTIN, M.D.

Leriche, R.: The Reflex Syndrome of the Neuroglioma in Old Severed Nerves Which Have Not Been Physiologically Repaired (Les syndromes réflexes du neurogliome dans les sections nerveuses anciennes non physiologiquement réparées). *J. de chir.*, 1939, 54: 304.

Leriche stresses the point that a cut nerve rapidly becomes something more than merely a severed nerve. The cicatrix at the upper end is the locus of trouble for nutrition of the distal tissue below and sometimes even above. He urges that the severed nerve should always be repaired in order to prevent the formation of a cicatricial neuroglioma. If the ends of the nerve are separated too far for end-to-end suture a nerve graft should be used. The author prefers grafts taken freshly from man or the dog.

The author quotes the statistics which Gosset gave in 1923 on the regeneration of nerves following end-to-end suture, namely, the radial nerve 56 per cent, the median nerve 44 per cent, and the ulnar nerve 17 per cent, the sciatic trunk 40 per cent, the external popliteal nerve 50 per cent, and the internal popliteal nerve 40 per cent.

Formation of the neuroglioma on the end of the severed nerve may result in vasomotor disturbances, secondary muscular contractures, painful disturbances, and trophic ulcerations. The author suggests also that this formation of a neuroglioma might result in the appearance of cardiac difficulties, such as anginal, asthmatic crises, and perhaps even arterial hypertension. FREDERIC W. ILFELD, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Brown, A. L.: Pectus Excavatum (Funnel Chest). *J. Thoracic Surg.*, 1939, 9: 164.

Pectus excavatum, called "Trichterbrust" in German, is that deformity of the thorax which is characterized by a funnel-shaped depression of the sternum. The apex of this funnel is located at the level of the junction of the xiphoid with the gladiolus. According to this author a distinction should be made between the indications for operation in an infant and those in an adult. Furthermore, he believes in prevention or correction of the defect and states that this is indicated in infants because of definite functional restrictions upon the circulatory and respiratory mechanisms which may develop later and because of the definite esthetic value of the operation, especially in women.

In 1596 Bauhin described this condition accurately and stated that the pull of the diaphragm is the actual cause. In 1882 Ebstein made an exhaustive study and description of this condition.

The sternum, consisting of three parts—the manubrium, the gladiolus, and the xiphoid, acts at its upper end as a support to the clavicle. The beginning of the funnel-shaped depression present in Trichterbrust occurs at the junction between the manubrium and the gladiolus. The manubrium may remain in its normal plane but the lower end of the sternum becomes depressed. The various portions of the sternum, the ribs, and the xiphoid are firmly fixed by dense ligamentous fibers. The diaphragm has two slips which arise from the undersurface of the sternum near the junction of the xiphoid with the gladiolus and the diaphragm; furthermore, it has a diffuse origin upon the inner surfaces of the cartilages and adjacent portions of the pericardium. One of two conditions may exist in patients with depressions of the sternum. The heart may be held in the midline and encroached upon by the depressed sternum, or it may be displaced either toward the right or toward the left thoracic cavity. The greatest cardiac embarrassment appears to be present when the heart is fixed near the midline and is directly compressed by the depressed sternum.

The etiological factors include intra-uterine pressure abnormalities, intra-uterine overdevelopment of the corpus sterni, arrested development of the sternum, rachitic influence on the development of the sternum, obstruction in the upper air passages, genetic factors, and neurological factors. This author believes that genetic and neurological factors play important rôles. In 1936 Nowak examined 30,000 Viennese school children and found 0.4 per cent to be afflicted with Trichterbrust. All of them had indications of this deformity since birth. He further found that heredity obviously was an important factor.

This author then presents cases which had been operated upon by him for this condition. Case 1 was that of a white boy seven years old. From the operation and the results obtained in this case, the author concludes that elevation of the suppressed portions of the sternum, cartilages, and ribs alone may correct the obvious skeletal deformity, but the contracted and depressed substernal ligament must be sectioned also. This allows for extension of the chest on the abdomen and prevents regeneration of bone in a depressed position from the otherwise

a b

Fig. 1. Comparative anterior views of the patient, showing depression of sternum and flexion of chest on abdomen. a, Before operation; b, after operation.

a b

Fig. 2. Comparative lateral views of same patient shown in Fig. 1. a, Before operation; b, after operation.

depressed ligament and its attached periosteum and perichondrium. Failure to section this ligament has most likely been the cause of so-called recurrences in previously reported unsuccessful cases. Furthermore, section of the substernal ligament corrects the deformity consisting of the flexion of the chest upon the abdomen, general sunken appearance of the chest, and round-shoulder habitus. The deformity is present in all cases of Trichterbrust to a greater or lesser degree.

With the noted anatomical facts and operative experience as a guide, a simple and more successful operative procedure was devised by this author for this condition.

Case 2 was that of a white man twenty-two years old. From this case the author drew the following conclusions:

Transverse section of the xiphoid and the underlying substernal ligament immediately gave access to the undersurface of the sternum. The excision of a transverse wedge of bone through the anterior table at the upper end of the sternum, where the depression began, allowed for elevation of the lower end of the sternum. The final degree of correction of the depression or, in other words, elevation of the lower end of the sternum, was regulated entirely by the width of the base of the wedge section removed. Stripping the sternum from the substernal ligament through the inferior approach was simple and greatly diminished the danger of entering the mediastinum. Fixation of the sternum in the elevated position was accomplished by suture of the approximated edges of the removed wedge with wire. Further fixation was obtained by another wire suture through a distal end of the sternum which approximated a rib stump laterally. As a safety factor, a temporary wire suture may be placed through the lower portion of the elevated sternum, the ends of which suture are brought out through the skin and ultimately tied over a bar which is placed transversely across the outside of the chest at the level of the suture. This bar may rest on sponge rubber pads, glued to the skin. This is a safety factor and may not prove to be essential in the technique. As a result of this operation the mediastinum need not be entered except for the small transverse incision of the substernal ligament. Thereby the dangers of mediastinal infection, pneumothorax, and hemorrhage are greatly diminished or entirely eliminated.

The third case was that of a child twenty-nine months old. From this operation the author concluded that the substernal ligament can readily be sectioned and the sternal attachments of the diaphragm safely freed. In consequence of the sectioning of this ligament and the sternal attachments of the diaphragm, there resulted an apparent marked decrease in the degree of depression of the sternum. No final judgment as to the value of this procedure can be made until the patient has been observed over a longer period of years. Since the operative procedure employed here appears to be essentially safe and simple and to accomplish its purpose, its use in developing cases of pectus excavatum is suggested by this author as a possible means of arresting the progress of the deformity.

The author reports 2 additional cases, 1 in a boy nineteen months old and 1 in a boy five years old.

J. Daniel Willems, M.D.

Janes, R. M.: Primary Tumors of the Ribs. *J. Thoracic Surg.*, 1939, 9: 145.

Metastatic tumors of the ribs are very common; primary tumors, on the contrary, appear to be relatively rare. A brief review of the available literature on rib tumors is given and 8 new cases are added. The series is made up of 1 giant-cell tumor, 2 so-called single myelomas, 1 chondroma, 1 osteochondroma, 1 chondrosarcoma, 1 osteogenic sarcoma, and 1 tumor which was regarded, from the roentgen appearance, as a typical osteogenic sarcoma, but which, because of its response to irradiation, may be a Ewing's tumor. Single myelomas of the ribs have not been reported previously, so far as the author has been able to determine. Two have come under his care. Chondromas and osteochondromas probably arise, as in the long bones, from cartilage rests and would be properly regarded as enchondromas or ecchondromas. There is nothing on which to base an opinion regarding the tendency of these benign lesions to undergo malignant changes.

Joseph K. Narat, M.D.

Harper, F. R.: Benign Chondromas of the Ribs. *J. Thoracic Surg.*, 1939, 9: 132.

Benign tumors of the ribs are not so rare that they can be considered medical curiosities. The author supplements a review of a group of cases collected from the literature by reports of 1 case of benign chondroma of the rib and 1 case which may be that of a myxomatous degeneration of a chondroma or a latent bone cyst, which is a form of osteitis fibrosa. These tumors start insidiously and are generally of long duration. For the most part, the tumor is discovered accidentally by either the patient or the doctor. Pain has often been mentioned as an indication that a chondroma is undergoing malignant change, but as it may occur also in benign chondromas, it is not an accurate diagnostic criterion of malignant change.

Regarding the nature of benign chondromas and osteochondromas, the author gained the impression of much duplication and confusion in the literature. The words osteoma, exostosis, fibroma, and myxochondroma have been loosely used. It would seem that the benign osteogenic tumors of the ribs could all be classed as either chondromas or osteochondromas. All of these tumors contain cartilage, bone, osseous tissue, and fibrous connective tissue. The osteochondromas or exostoses arise as bony tumors and are surrounded by a cartilaginous cap. The chondromas contain adult cartilage primarily, but may ossify to form osseous chondromas, or they may undergo myxomatous degeneration and be called myxochondromas.

Three theories regarding the origin of chondromas seem to be prevalent: that chondromas originate (1) from fetal rests, (2) from islands of cartilage resulting from rickets, or (3) as a result of trauma. The osteochondromas seem to arise from the tendinous attachments, and the chondromas arise from joint cartilage.

The opinions in the literature seem to be almost unanimous that chondromas, even though they appear histologically benign, are prone to recur and to become malignant. They should, therefore, be considered as potentially malignant tumors. While a few authors have advised irradiation, the overwhelming majority of opinion is in favor of early and complete removal. The complete removal is important because of the danger of recurrence even though the tumors are histologically benign. Early and complete removal is even more important because of the danger of malignant changes which may take place in these tumors at any time in the course of their development. JOSEPH K. NARAT, M.D.

Friedman, M., Finkler, R., and Antopol, W.: The Relation of Ovarian Hormones to Benign Breast Hyperplasia and Neoplasia. *Radiology*, 1939, 33: 725.

This paper is based upon a study of 60 women who complained of painful breasts, nodular breasts, discharge from the nipple, or a combination of these symptoms. The following order of procedure was maintained whenever possible:

1. Four consecutive bio-assays of the blood and urine for prolan and estrin were made; thus a complete hormone study consisted of 16 determinations.
2. Four weekly endometrial biopsies were obtained by means of the Novak suction curette, usually on the same day that the bio-assays were performed.
3. A biopsy of the breast was made, preferably premenstrually.
4. A therapeutic trial was made with either hormone or x-ray therapy.
5. The patient was observed thereafter at frequent intervals over a period of from one to five years.

In 9 patients, a complete series of 4 consecutive weekly endometrial biopsies was performed. In 7 patients only 1 endometrial biopsy was performed, usually premenstrually. Forty-five biopsies of the breast were made. Seventeen patients were treated with various estrogenic preparations. Five patients received gonadotropic-hormone therapy in the form of Antuitrin-S. Eight patients were treated by x-irradiation directly to the breast, 11 received x-ray irradiation of the pituitary gland, and 10 received irradiation of the ovaries.

The authors arrived at the following conclusions:

1. Bio-assays of the blood and urine in cases of benign breast neoplasia and hyperplasia reveal that the titers of most of the patients fall within normal limits. It is, therefore, probable that any influence which estrin might exert on the breast is not essentially a function of the quantity of the hormone in the blood or urine.
2. Endometrial biopsies contribute but little information toward this disease.
3. Histological studies of breast biopsies taken at a specific time during the menstrual cycle show no consistent pattern which could be correlated with either endometrial studies, hormone bio-assays, clinical pictures, or therapeutic responses.
4. Because of the absence of detectable manifestations of endocrine irregularities, the rôle of the ovarian hormones in the development of various benign abnormal processes in the breast is still undetermined.
5. The rationale of estrin therapy is not clearly understood; its effectiveness is yet to be proved beyond any question of doubt.
6. Antuitrin-S was found to have no therapeutic value in our cases.
7. Direct breast irradiation was of no value in 8 patients treated therewith.
8. X-ray stimulation of the pituitary gland, or the ovary, or both, was found to be of no value.
9. X-ray castration is apparently promising but the results are not clear-cut. Frequently one year elapses after castration before the maximum therapeutic effect is produced. It is recommended that a larger than usual castration dose be employed, i.e., a depth dose of 800 roentgens (measured with scattering) to each ovary, in order to destroy the more resistant follicles. SAMUEL H. KLEIN, M.D.

Ross, J. P.: An Investigation into the Effects of Radium upon Carcinoma of the Breast. *Brit. J. Surg.*, 1939, 27: 211.

The radium treatment of operable carcinoma of the breast by the method which has since become known as the "Keynes technique" was started in the Surgical Professorial Unit at St. Bartholomew's Hospital in 1924. This was done only after a preliminary trial of the method for the treatment of cases of inoperable or recurrent carcinoma had yielded results which were so encouraging that the staff was led to believe that their patients were running no additional risk by submitting to radium treatment instead of radical mastectomy. The subsequent experience has amply justified their faith.

Radium needles were inserted according to a uniform technique. The needles contained either 3 mgm. or 2 mgm. of radium (active length 4.8 cm. and 3.2 cm., respectively), filtered by either 0.5 mm. of platinum in the earlier cases, or 0.8 of platinum in the later series. The 3-mgm. needles were placed just at the edge of the tumor, not into it, so as to irradiate it from its deep aspect; upon the pectoral fascia to irradiate the whole breast from below; in the axilla along the chest wall, converging toward the apex and reaching as high as possible; and below the clavicle, being passed through the pectoralis major muscle to lie upon the costocoracoid membrane. Needles were always placed in this position, and in almost all of the cases 2-mgm. needles were inserted

into the upper 4 or 5 intercostal spaces at their anterior ends (the points of the needles being in contact with the border of the sternum), and also above the clavicle in the posterior triangle of the neck. However, the author doubts the value of these last 2 groups of needles. At some convenient time during the subsequent week a roentgenogram was made for record purposes to show the position of the needles.

An account is given of a histological study of 50 cases of carcinoma of the breast examined three months after, and of 22 cases examined six months after the insertion of the radium. Examination of all parts of the breast tissue in the early cases failed to reveal any secondary foci in the breast itself.

Carcinoma of the breast occurs in several histological types which vary in their sensitivity to radium treatment. There is some evidence that axillary metastases show a similar variation. It follows from this that it is wise to excise the primary tumor as a step in radium treatment, and that radical mastectomy must be the safest treatment for carcinoma in its early stage.

The effects of radium upon metastases in the axillary glands are better than is commonly supposed, and experience shows that in all but the early stage of carcinoma of the breast results may be obtained by radium treatment which are as good as, and may be better than, those obtained by radical mastectomy. JOSEPH K. NARAT, M.D.

Whitmore, E. R.: Carcinoma of the Breast, with a Consideration of Whole-Organ Section Studies. *Radiology*, 1939, 33: 737.

The author recommends the use of whole-organ sections for the study of dissemination of carcinoma of the breast. Sections from the cases of other authors, and from a case of Whitmore's, are illustrated. These show the various pathways of spread of malignant breast tumors.

Whitmore also stresses the importance of removal of the fascial lymphatic plexus in the radical operation for carcinoma of the breast. The lymphatics of the breast lead directly down to the lymphatic plexus on the pectoral fascia, and through this plexus to the axillary lymph nodes. Tributaries from this plexus extend through the chest wall to lymph nodes beneath the pleura; they also connect with the abdominal lymphatics through the epigastric angle, and then with the abdominal organs, especially the liver. SAMUEL H. KLEIN, M.D.

TRACHEA, LUNGS, AND PLEURA

Edwards, P. W., and Lynn, A.: Closed Intrapleural Pneumolysis. *Brit. M. J.*, 1939, 2: 897.

The authors report 235 cases of closed intrapleural pneumolysis, and in one-half of the patients the disease was far advanced. In 20 patients a bilateral operation was performed. In 34 per cent it was possible to divide all of the adhesions; in 55 per cent partial division was possible and in the remaining 11 per cent the condition was found to be inoperable.

Satisfactory results, radiologically, were obtained in 39 per cent of the patients; 14 per cent showed improvement but not enough, and in 28 per cent the condition was unchanged. Partial or complete symphysis followed the operation in 19 per cent of the cases. Of the patients who had only partial division of the adhesions 28 per cent had satisfactory collapse of the lung postoperatively.

Medial subapical adhesions rarely interfered with efficient collapse when the apex of the lung was below the clavicle in the lateral upright position. Lateral or latero-apical adhesions may be usefully divided in patients with inoperable medial apical adhesions or apical symphysis in the presence of patent cavities below the level of the clavicle.

Most frequently satisfactory results were obtained with limited lesions in afebrile patients.

Aside from effusions, complications were rare. Effusion occurred in 32.8 per cent of the authors' cases. In 24.4 per cent of the cases the effusion was persistent. While transient effusion did not materially affect the end-results, persistent effusion was seldom compatible with good end-results.

Effusions were most common in patients with advanced disease, any degree of fever, rapid sedimentation rates, or in patients in whom extensive cauterization was found to be necessary.

EARL O. LATIMER, M.D.

Blades, B., and Graham, E. A.: The Surgical Treatment of Intractable Pulmonary Hemorrhage. *New Internat. Clin.*, 1939, 4: 77.

Conservative measures including phrenic neurectomy and artificial pneumothorax will control pulmonary hemorrhages in most instances. However, in a small group of cases bleeding may be intractable and incontrollable by these methods. When they fail, removal of one lobe or thoracoplasty may offer the only hope of saving life.

The authors call attention to the fact that the location of the site of the hemorrhage must be exactly determined. A careful history and physical examination with roentgen rays and bronchoscopic examination will usually reveal the site. Bronchoscopic examination is exact and is most helpful in visualization of the bronchus from which blood is flowing.

The authors report 7 cases in which lobectomy was performed and 2 cases in which extrapleural thoracoplasty was performed to control the bleeding. The cause of the hemorrhage and the response to other forms of collapse therapy were deciding factors in the selection of the proper procedure.

In non-tuberculous disease lobectomy is the operation of choice, although lobectomy was performed in 2 cases of atypical tuberculosis, not diagnosed as such before operation, with excellent end-results.

On 2 patients with pulmonary tuberculosis extrapleural thoracoplasty was performed to stop the bleeding. There were 5 patients with bronchiectasis on whom lobectomy was performed, the chief indication being intractable bleeding.

There was 1 death among the 9 patients. The patient died from suffocation or drowning by blood during the operation. Hemorrhage was so profuse that the blood could not be aspirated fast enough to maintain an adequate airway. In the authors' opinion this is probably the chief hazard in the performance of such a major procedure during a pulmonary hemorrhage.

The authors carefully point out that patients in the terminal stages of pulmonary disease are not fit subjects for major operative procedures. There are patients, however, whose disease is not so extensive as to preclude recovery if the symptom of intractable hemorrhage can be controlled. Conservative means may fail and when they do radical measures can be offered the patient with a comparative low risk and with excellent chances of controlling the bleeding and permanently curing the underlying pathology.

JULIAN A. MOORE, M.D.

Lardennois, G., and Monod, O.: Semb's Operation in the Operative Treatment of Pulmonary Tuberculosis (L'opération de Semb dans la cure opératoire de la tuberculose pulmonaire). *J. de chir.*, 1939, 54: 458.

Lardennois and Monod note that Semb described his method for collapse of the lung in 1935, and designated it as thoracoplasty with extrafascial apicolysis. The collapse of the apex of the lung is obtained in this operation by extensive subperiosteal resection of the four upper ribs and detachment of the upper part of the pleura and lung by a special technique so that the muscles, fascia, and various connective-tissue structures forming the endothoracic fascia are left adherent to the parietal pleura.

The authors have used Semb's operation in 40 cases; they prefer to operate under local anesthesia. The resection of the first four ribs is begun with the fourth rib; approximately 12 cm. of each rib is removed to give a sufficiently large operative field. The extrafascial detachment of the pleura is begun in the fourth intercostal space; the blood vessels are ligated and cut between two ligatures. The detachment of the dome of the pleura is carried on under complete visual control; it is in this entire stage of the operation that all connective structures and fascia are sectioned at a distance from the parietal pleura so as to leave much of this tissue adhering to the parietal pleura. The detachment of the pleura is then carried on downward toward the hilus.

Semb's operation is indicated in cases with a unilateral apical cavity; it is an extensive and prolonged operation; in 9 of 49 of the authors' cases in which this operation was considered to be indicated, it had to be abandoned as too difficult, and an ordinary thoracoplasty was done. In the 40 cases in which the Semb operation was carried out there was no postoperative mortality. There were 2 complications: in one case, a secondary hemorrhage which was slight and did not interfere with recovery; in the other, a suppurative process that persisted for two months and apparently rendered the prognosis less favorable. In this series of 40 cases, the results were superior to those obtained with pneumothorax and equal to those obtained with ordinary thoracoplasty, while improvement was more rapid than after the latter procedure. Of 59 cases in which ordinary thoracoplasty was done in 1935, 75 per cent have been cured, but in many of these cases a multiple-stage operation was required, while Semb's operation requires only one stage. The patients for Semb's operation, however, must be selected with special care.

ALICE M. MEYERS.

Edwards, F. R.: Studies in Pneumonectomy and the Development of a Two-Stage Operation for the Removal of a Whole Lung. *Brit. J. Surg.*, 1939, 27: 392.

Thirty pneumonectomies (12 left and 18 right) were performed on rabbits under endotracheal differential pressure anesthesia with ether and oxygen. There was 1 death. In 21 additional rabbits the pulmonary artery was ligated. Of these, 7 died. In 4 rabbits pneumonectomy was done in 2 stages, the first stage consisting of ligation of the pulmonary artery, the second, of pneumonectomy fourteen days later. The surviving animals were examined at varying intervals of from fourteen days to five months after operation.

Among the immediate changes produced by the operation was a rise in the respiratory rate of from 30 to from 60 to 80 per minute. The rise was greater after removal of the right than after removal of the left lung. Within ten days the rate had dropped to normal. There was an immediate rise in the hemoglobin and erythrocyte count; and a small pleural effusion developed, which disappeared rapidly. As the fluid and air were absorbed from the pleural cavity, the heart and mediastinal structures were displaced to the operative side. The heart was rotated around an axis extending from the superior to the inferior vena cava, as these deviate but slightly from their fixed attachments. The ventricles swung in whichever direction they were pushed by the remaining lung. The blind ends of the pulmonary artery and veins did not thrombose. This is an important observation and explains the infrequency of embolic phenomena after pneumonectomy. The remaining lung increased in size, most of the increase occurring in the lower lobe. Studies indicated that this was due to hypertrophy and not to emphysema. The esophagus, having no thoracic attachments, was deviated quite markedly.

The dead space was not truly obliterated. The ribs became more oblique, the diaphragm rose, but the pleural cavity was not filled with fluid or fibrin. There was a marked increase in fat in the thorax, which helped in filling it.

From these studies the author concluded that the most likely cause of shock during the operation is rotation of the hilum. Rotation posteriorly produces little change in the blood pressure, but rotation anteriorly produces a marked drop in the blood pressure,

and if prolonged produces convulsions and rapid deterioration of the animal. This rotation produces a distortion of the pulmonary artery and causes obstruction; the right ventricle dilates, the blood flow through the lung to the systemic circulation diminishes, the blood pressure falls, the respirations become irregular and deeper, and convulsions may develop.

The effect of pneumonectomy on the pulmonary circulation is a reduction by one-half at once, with a rise in pulmonary artery pressure of from 20 to 30 mm. Hg. This gradually subsides as the vessels in the remaining lung dilate. The systemic blood pressure falls from 10 to 15 mm. Hg. The remaining pulmonary artery and veins dilate immediately to twice their normal size and remain so permanently.

Ligation of the pulmonary artery alone produces all of the afore-mentioned effects to a less degree. The lung becomes atelectatic but does not become necrotic since it receives nourishment through the bronchial arteries.

The author's experiments with a two-stage pneumonectomy suggest that ligature of the pulmonary artery allows the respiratory and vascular changes associated with pneumonectomy to occur without gross displacements of the thoracic anatomy. At the second stage, when the lung is amputated, dyspnea is much diminished in amount and is shorter in duration.

The success of pneumonectomy in man depends upon the ability of the contralateral lung to take over the function of the two lungs, and the ability of the pulmonary vascular system in the contralateral lung to adapt itself to a permanently increased flow. Shock can be minimized by a preliminary intercostal nerve block, by injection of novocaine into the hilum, and by avoidance of traction on and rotation of the hilum. Blood transfusions and intravenous infusions should be given slowly because the right ventricle is likely to dilate.

Leakage from the bronchial stump is one of the most potent causes of death after pneumonectomy. The author is of the opinion that crushing of the bronchus with linen and a simple ligature of it is the best means of closure.

In children compensation takes place very rapidly, but in adults it may not do so. This is true especially in elderly people. The author believes that a two-stage procedure may eliminate some of the dangers of pneumonectomy.

JULIAN A. MOORE, M.D.

HEART AND PERICARDIUM

O'Shaughnessy, L.: Cardiac Decompression by Mobilizing the Chest Wall. *Lancet*, 1940, 238: 61.

In the adult thorax the rigid walls of the mediastinum enclose a relatively small space. Through this space pass very vital organs, vessels, and nerves, the function of which may become fatally impaired as a result of pressure exerted on them by a mediastinal tumor.

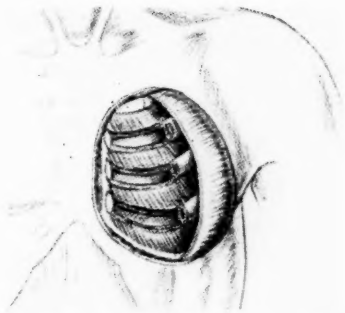

Fig. 1. Costal method of cardiac decompression.

Likening the hypertrophied heart to a tumor of the mediastinum, it is not unreasonable to assume that death may result from pressure alone, irrespective of the intrinsic cardiac lesion which exists.

In childhood the chest wall possesses a certain ability to yield in response to pressure. Once it has become fully developed, however, this ability no longer exists. The restoration of a yielding precordium by artificial means would therefore seem to be a logical procedure for the relief of intrathoracic pressure.

Several methods for the attainment of this end have been devised but as yet no standard technique has been widely adopted. Three possible methods are discussed by the author.

One of these is illustrated in Figure 1. A detailed case report is cited wherein this procedure produced immediate and rather spectacular relief of the symptoms. By means of a semilunar incision the third, fourth, and fifth costal cartilages and their perichondrium were excised and subperiosteal resection of 2 or 3 cm. of the corresponding ribs was done. The internal mammary vessels were exposed, ligated, and divided. After freeing of the sternum from the adjacent soft tissues it was removed piecemeal as far as the midline. The pericardium was exposed by stripping back the mediastinal pleura. The wound was closed in layers and, except for a transient left pleural effusion and slight hemorrhage from the upper part of the wound, recovery was uneventful.

The author has performed median sternotomy for relief of mediastinal pressure symptoms due to aortic aneurysm. He suggests a modification of this operation, wherein a combined superior and inferior sternotomy is done in two stages, as a second useful procedure in patients with cardiac hypertrophy.

Whether the fibrous pericardium exerts a beneficial limiting effect in acute cardiac dilatation, or is harmful and hastens cardiac failure is a moot point. Having obtained excellent results by incision of the pericardium in racing greyhound dogs, the author believes that further experimentation with this third method of decompression is warranted in selected cases with an established, incurable, and progressive heart lesion. EDWARD W. GIBBS, M.D.

ESOPHAGUS AND MEDIASTINUM

Teppati, M.: A Contribution to the Study of Mega-Esophagus (Contributo allo studio del megaesofago). *Minerva med.*, 1939, 30: 488.

Teppati describes 2 cases of mega-esophagus which he has observed during the past two years. The disorder usually occurs in subjects aged from twenty to forty years, and the syndrome, which begins gradually with spontaneous alternations of aggravations and improvements, is always associated with a more or less marked degree of neuropathy. In the beginning, there is sudden regurgitation after the first mouthfuls and later there is stagnation of food as a result of the increase in the dilatation. Dysphagia occurs first with solid food and later with fluids; the patient tries to overcome this by various artifices. Retrosternal oppression and constriction, eructation, and fetid breath are frequent. In time, the passage of food through the cardia becomes impossible. In the meantime, the patient becomes weak through chronic malnutrition and may have symptoms of compression of the trachea and of the aorta. Mediastinitis or tumor may develop and death occurs from cachexia or septic and neoplastic complications.

The clinical diagnosis of idiopathic dilatation of the esophagus is difficult in the beginning, but becomes easier after a period of observation; it should be made only when other lesions have been excluded which might cause secondary dilatation, such as lesions of the stomach, the mediastinum, and the esophagus itself (cicatricial or congenital stenosis, diverticulum, and tumor). As the objective signs may be scarce, direct esophagoscopy and roentgen examination should not be neglected. When the esophagus is filled, it may give typical percussion signs; rarely, there is displacement of the cardiac apex toward the left, but usually compression of the esophageal sac causes a certain degree of tachycardia. Auscultation may reveal absence of the typical deglutition noise along the thoracic spine or the presence of a dripping noise; Zenker's noise of the cardia may be absent or retarded. The direct examination of the esophagus may be completed by the use of olivary sounds which, being arrested at the cardia, will show a lengthening of the esophagus. Esophagoscopy is not without danger and is therefore rejected by many in favor of roentgen examination. A tube, at least 50 cm. long, is needed.

Roentgen examination is indispensable and shows in the frontal projection that the mediastinal shadow is abnormally displaced and usually toward the right of the spine, with very marked opacity which ceases suddenly in the upper part; the entire profile of the esophagus can be followed in oblique projections, showing the varying form of the organ. Sudden shaking of the patient may reveal small waves in the upper part of the barium column, and the pulsations of the heart may be communicated to it. Ingestion of more barium solution may cause sudden emptying of the esophagus into the stomach. Esophageal peristalsis is generally absent and spasm of the cardia is present, but is overcome when the column of fluid in the esophagus reaches a height of from 20 to 25 cm. Before the roentgen diagnosis of mega-esophagus is made, the possibility of lesions of neighboring organs must be eliminated, such as mediastinal pleurisy, saccular pericarditis, and mediastinal pneumothorax.

Numerous theories have been proposed to explain the pathogenesis of the disorder and each of them is supported by clinical and anatomicopathological experimental observations. Cases of patients who have survived for thirty years and of others who have died from inanition, notwithstanding gastric fistula, have been reported. The treatment may be medical or surgical. Conservative treatment gives good results in slight and beginning cases; soft and greasy food is passed more easily than ordinary food. In case of stagnation, the sound is used with repeated lavage with alkaline solutions. Drugs which act on the sympathetic system are recommended to relieve spasm of the cardia. Recourse may be had to dilatation of the cardia with conical sounds. Surgery is necessary in serious cases; the creation of a gastric fistula is indicated to feed the patient and at times to try retrograde dilatation of the cardia. Other operations on the esophagus and the cardia have been recommended; all are difficult and serious, while their result is uncertain and recurrences are frequent.

RICHARD KEMEL, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Slater, R.: The Inadequacy of Injection Treatment of Hernias. *New England J. Med.*, 1939, 221: 895.

This report concerns a four-year study of 20 patients with inguinal hernia treated by the injection method at the outpatient department of the Beth Israel Hospital, Boston. Approximately 50 patients began the treatment but only 20 continued through a full course. Those who discontinued treatment did so because of pain following the injections, the annoyance of wearing a truss continuously day and night, or occasional untoward reactions. A full course of treatment consisted of about 20 injections given a week or more apart, the number varying with the case. Adequate treatment was considered to have been given when complete fibrosis of the canal was present, the patient could comfortably dispense with the truss, and no impulse was detectable. Of the 20 patients, 10 had direct and 10 had indirect inguinal hernias. They varied in age from twenty-eight to seventy-five years. The solutions used were: Mayer's solution (11 cases), sylassol (5 cases), and tripoli suspension (4 cases). All patients were discharged as cured from one to two years after the treatment started. Observations were continued in all cases from two to four years after the first injection. At the end of four years it was found that in 18 cases the hernia had returned. The 2 cured cases (still intact at the end of four years but which may yet present recurrence) were 1 small indirect hernia and 1 moderate-sized direct hernia. In many of the recurrences the hernia was of such size that a whole new course of treatment would be necessary. Complications were few. Two patients were in shock for several hours after treatment and required morphine and emergency-ward care. Five had painful cords, which condition persisted for from three to five weeks. Nearly every patient had some local pain and in 2 cases the patients could not resume work for several days. Two patients had to have emergency treatment for strangulated hernia, the repair of which was more difficult because of the fibrosis and inflammatory reaction.

It appears that the injection treatment of hernias is not satisfactory and should be used only when the patient must not be operated on, and then only after the method of treatment and its potentialities for cure have been fully explained to the patient.

MANUEL E. LICHTENSTEIN, M.D.

Gurd, F. B.: Transverse Incision of the Abdomen —the Laparotomy Wound of Choice. *Canadian M. Ass. J.*, 1940, 42: 10.

Gurd discusses the advantages of the transverse abdominal incision. The major disadvantage of this incision, no matter how fashioned, is that the aponeurotic structures are cut across the direction of their strong fibers, that is, at right angles to the line of greatest strain. The lesser disadvantage is that there is a great risk in those incisions which either split or displace the rectus muscle in that three or more intercostal nerves may be damaged or destroyed.

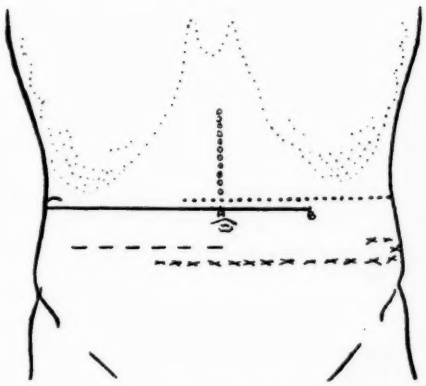

Fig. 1. Diagram illustrating the abdominal wall to show site of recommended incisions.
———Skin incision for cholecystectomy and exploration of bile passages. Resection of hepatic flexure A. For gastrotomy or gastro-enterostomy B.
– – – – Skin incision for appendectomy and exploration of pelvis and terminal ileum.
. . . . Skin incision for splenectomy. Resection of splenic flexure.
x x x x Skin incision for resection of descending colon, abdomino-perineal resection. (Similar incision on opposite side for operations within pelvis may be used.)

The transverse incision is more anatomical and, if properly fashioned, makes it easier to expose and operate upon the abdominal viscera. Since less forceful retraction is required less trauma is inflicted on the abdominal wall, and hemorrhage, infection, and shock are less likely to occur. The author is of the opinion that patients with transverse section of the upper abdomen have much less postoperative pain and are able to cough with little distress; they can therefore clear the bronchi of mucous and mucopurulent plugs. This tends to diminish the incidence of pulmonary atelectasis and pneumonitis. Gurd is further of the opinion that this type of incision produces much less postoperative hernia, painful scar, and fixation of the abdominal viscera than the vertical incision.

It should be determined before operation whether operative procedures within the abdomen are to be carried out chiefly above or below the umbilicus and chiefly to right or left of the midline in order that the incision be placed properly.

Whether the incision is to be above or below the umbilicus, it should never be made farther away from this structure than 2.5 cm. (1 inch). If the incision be placed farther away from the umbilicus a sufficiently long incision may not be possible in consequence of the fact that either the rib border or the pelvic bone is encountered.

Although most cholecystectomies and all appendectomies can be easily performed without division of the rectus muscle, no attempt should be made to save this structure at the expense of inadequate exposure. Sound healing can be expected in all cases, except, occasionally, in the presence of cachexia or phagedenic infection. J. M. MORA, M.D.

Owen, C. R.: An Experimental Study of the Bacteriology of Perforation Peritonitis. *Surgery*, 1940, 7: 37.

The author joins the ranks of those who believe the colon bacillus to be the chief offender with regard to perforation peritonitis.

By means of the intraperitoneal inoculation of guinea pigs, rabbits, and white mice with a saline suspension of cecal contents obtained from guinea pigs, rabbits, and human beings, two outstanding observations were made:

1. Organisms of the coliform group were isolated very frequently from the peritoneal fluid of those animals which died with peritonitis, whereas streptococci were encountered only rarely.

2. Animals injected with cecal contents containing few or no coliform organisms rarely developed a fatal peritonitis.

Although many strains of colon bacilli occurring in the intestines are potentially virulent, the author was unable to differentiate the pathogenic from the non-pathogenic strains on a basis of cultural characteristics, hemolytic property, or agglutination tests. EDWARD W. GIBBS, M.D.

GASTRO-INTESTINAL TRACT

Bisgard, J. D., and Johnson, E. K.: The Influence of Certain Drugs and Anesthetics upon Gastro-Intestinal Tone and Motility. *Ann. Surg.*, 1939, 110: 802.

Even though surgical trauma is the principal causative factor of postoperative gastro-intestinal symptoms such as nausea, vomiting, distention, and gas pains, the results of clinical and experimental studies by the authors indicate that anesthetics play a greater rôle than is generally attributed to them. These studies also show that some anesthetic agents are inhibitory and that others are predominantly stimulating to the movements of the gastro-intestinal tract. Anesthetics which have an inhibitory action are associated more frequently with disturbances of gastric and intestinal function, and the symptoms of such disturbances are, on the whole, more severe and of longer duration.

In a series of 408 cases of patients who had had celiotomies with uncomplicated convalescences, the authors found the incidence of postoperative vomiting higher following the administration of ether anesthetics, nitrous oxide and ether, and nitrous oxide alone, while it was strikingly lower following cyclopropane, avertin-cyclopropane, and spinal anesthesia. Distention and troublesome gas pains were markedly reduced following avertin-cyclopropane anesthesia as compared with these conditions following other anesthetic agents. There are, however, some misleading facts. Vomiting which occurred in the operating room before the patients were returned to their rooms was not recorded. Also, there were many children in the groups who received ether and nitrous-oxide anesthetics. Children vomit with less provocation, and the vomiting is more persistent than that of adults.

Direct observations of gastric and intestinal motor activity were made during, and for varying periods following, anesthesia in human beings and in dogs. Activity of the stomach and bowel was recorded upon continuous kymographic records which registered pressure changes upon inflated balloons fastened to the ends of indwelling Levine tubes. In human subjects, double Miller-Abbott tubes were swallowed and retained in the stomach, or were permitted to pass into the small bowel. In the dogs, the tubes were passed into permanent fistulas of the stomach, small intestine, and colon.

Records were made during: (1) a pre-anesthetic control period, (2) the induction of anesthesia, (3) full surgical anesthesia, (4) a recovery period of one hour or more, and (5) at varying postanesthetic intervals, some extending over periods of three days.

In brief, the effects of various drugs showed that morphine and pitressin had stimulating effects, and that atropine and nitroglycerine had inhibitory effects on the gastro-intestinal tract. Morphine and atropine, combined, counterbalanced each other. Seconal (representative of barbiturates) had mixed actions; it was stimulating to the stomach and inhibitory to the intestine.

In the case of anesthetic agents, avertin, cyclopropane, and spinal novocaine were provocative of motor responses, while ether, nitrous oxide, and evipal caused relaxation of the gastro-intestinal tract.

When inhaled, oxygen stimulates and carbon-dioxide inhibits gastro-intestinal motor activity. This suggests that the influence an individual anesthetic has upon the gastro-intestinal tract may be dependent on its influence upon the relative quantity of oxygen in the blood or tissues during the anesthesia. SIDNEY S. QUARRIER, M.D.

Choldin, S. A.: Three Years' Experience with Electrosurgical Anastomosis in the Gastro-Intestinal Tract. *Vestnik khir.*, 1939, 58: 213.

As peritonitis seems to be the most frequent cause of death after operations for gastric cancer, countless attempts have been made to develop aseptic methods. Some of them must be rejected because they establish a patency of the stoma only after from one

to four days following the operation. Others are complicated and require special instruments. The majority of the methods do not secure a hemostasis in a satisfactory manner and produce an inversion of the margins of the intestinal wall which may lead to a formation of a diaphragm and stenosis. Finally, the insufficient protection of the peritoneal cavity from the intestinal contents with a resulting infection is the result of the technique suggested by many surgeons. For these reasons the author offers a new method which in the course of three years has proved very satisfactory in gastric resections or gastro-enterostomies. It prevents the spilling of intestinal contents, produces hemostasis by electrocoagulation of the severed walls of the gut, and does not employ any suturing of the mucous membranes. A lateral anastomosis is performed in the following manner:

After the seromuscular layers of the intestinal loops have been incised, they are approximated with interrupted stitches. A wire, introduced at one end of the incision into the lumen of the intestines by means of a special needle, emerges at the other end and is bent in such a manner that it forms a loop, one branch lying within and the other outside of the lumen. The next step is the approximation of the seromuscular layers of the anterior portions of the intestines with interrupted stitches. Both ends of the wire loop are caught in a hemostat through which a high-frequency current is sent by means of an applicator. After the mucous membranes have thus been severed, one or two seromuscular stitches are placed at the site from which the wire loop has been withdrawn. The electrotomy of the mucous membranes accomplishes the necessary hemostasis. Experience showed that a single layer of interrupted stitches is sufficient for a dependable, tight approximation of the serous surfaces, but a second, continuous catgut stitch is advisable when anastomosis is performed on the large intestines.

The technique of a terminal anastomosis is still simpler and consists of the introduction of temporary, continuous mattress stitches with wire directly underneath the intestinal clamps applied to the severed intestines. After the clamps have been removed, a series of interrupted seromuscular stitches is applied. A diathermy applicator is placed in contact with hemostats holding the ends of the wires and in this manner electrocoagulation is produced. If desired, a second continuous catgut stitch may be applied.

The narrow coagulated margins of the severed guts cannot produce an obstruction and are separated from the normal walls after from five to ten days.

A terminolateral anastomosis is performed in a similar manner.

Several technical points deserve attention. Care should be taken not to carry the wire through the posterior wall as the current would cut it. The anterior seroserous sutures should avoid the wire stitch. The surgeon must have the assurance that the wire entered the lumen of the stomach or the intestines and has not been carried between the layers of the walls as otherwise the mucosa is not sectioned and no stoma is established. The passive electrode, covered with a wet towel, should be in close contact with the body to avoid burns.

Angiographic methods showed that an application of a current with a frequency of 5,000 or more per second, and 1.5 to 3 amperes, for from two to four seconds is sufficient to accomplish a perfect hemostasis in the sectioned gastric or intestinal walls. No considerable hemorrhage was noticed in 319 electro-resections and electro-anastomoses on man and 52 on animals. Serous layers were firmly united at the end of forty-eight hours, while the union of the mucous membranes required a much longer time, approximately three weeks.

The author employed his method in 208 gastric resections, among them 177 for cancer of the stomach, and 111 anastomoses in various portions of the intestinal tract.

The postoperative mortality in the entire series of resections was 10.7 per cent as compared with 18 per cent after the customary surgical methods. The corresponding figures for gastro-enterostomies were 7.8 per cent and 19.2 per cent, respectively.

A checkup after various periods of time after the operations failed to reveal any disturbances of the function of the anastomosis.

JOSEPH K. NARAT, M.D.

Terzani, A.: Gastric Carcinoma Occurring During a Complete Remission of Pernicious Anemia (Carcinoma gastrico manifestatosi in remissione completa di una anemia di Biermer). *Minerva med.*, 1939, 30: 360.

May a pernicious anemia form the basis for the development of a gastric carcinoma?

The author reports in detail the case of a sixty-three-year-old man whose father died of gastric carcinoma at sixty and whose sister died of gastric carcinoma at forty-five. For fourteen years previously the patient had had vague gastric distress. Two years previously he had noted a burning sensation in the tongue. For three months he had noted edema of the extremities which diminished on rest in bed. He also had noted occasional paresthesia in the terminal phalanges of his hands. He presented marked asthenia, loss of weight, and anorexia. Roentgenological examination on the suspicion of duodenal ulcer indicated that the stomach was normal. The blood examination at that time (March 9, 1938) indicated pernicious anemia. There were no parasites or blood in the stools; roentgen examination of the digestive tract was negative; there was no lactic acid or galactose; the neutral red test was negative; the anachlorhydria was histamine resistant. Placed on parenteral liver therapy the patient recovered hematologically and clinically. By December, 1938, he had a normal blood picture and normal weight. However, after that his epigastric pains reappeared; he began to vomit and lose weight. X-ray examination on February 1, 1939,

demonstrated that the stomach was reduced to one-seventh of the normal size; it had the appearance of a rigid tube which emptied rapidly in fifteen minutes, and also of a "linitis plastica." Palpation revealed a diffuse resistance in the gastric region. Examination of the gastric juice indicated the absence of hydrochloric and lactic acids; blood was present at times. The blood examination was normal even seventeen days before the patient died.

After presenting the various clinical questions, the author notes that the anemia and the gastric carcinoma developed independently from the standpoint of time, as indicated by the detailed study of the evolution of the two maladies.

In all there are now 34 cases of gastric carcinoma which developed after a pernicious anemia. Although gastric carcinoma causes anemia, this is not of the Biermer type. Many believe that 50 per cent of gastric carcinomas develop on the base of a gastritis; Konjetzny maintains there is a gastritis in 90 per cent of carcinomas and that gastric carcinoma never develops on a healthy mucosa.

The author points out that the mixed atrophic-hyperplastic gastritis which occurs in pernicious anemia is resistant to liver therapy and may go on to develop into carcinoma. At any rate Velde has reported polypoid degeneration in 14 per cent of the cases of pernicious anemia which were examined. Heredity is also an important factor which must be considered. JACOB E. KLEIN, M.D.

Winters, W. L., and Egan, S.: The Incidence of Hemorrhage Occurring with Perforation in Peptic Ulcer. *J. Am. M. Ass.*, 1939, 113: 2199.

The impression that bleeding ulcers do not perforate and that ulcer perforations do not bleed has been generally accepted by physicians and surgeons as true. Finsterer in his vast experience reported the simultaneous occurrence of hemorrhage and perforation only three times. Blackford and his associates concluded that bleeding ulcers do not perforate and ulcer perforations do not bleed. However, this conclusion was questioned by James and Matheson who reported hemorrhage in the presence of perforation.

The authors reviewed the literature on this subject and found that in the cases reviewed the occurrence of hemorrhage varied from 1.5 to 18 per cent with an average of 8 per cent, and they stated, "Whether or not one is to defend the statement that bleeding ulcers do not perforate and ulcer perforations do not bleed depends greatly on what history can be obtained from the patient." They report the records of cases of perforated ulcer at the Cook County Hospital from 1935 to 1938, inclusive, which were studied to determine the incidence of hemorrhage. The question of hemorrhage itself was also studied because the amount of bleeding from an ulcer varies. Patients who bleed severely enough to cause faintness, syncopy, tachycardia, asthenia, palor, and signs of shock, are usually sufficiently alarmed to see a physician immediately. In general, the amount of hematemesis when estimated by the patient is too frequently greatly exaggerated. The question of melena is different. The quantity of blood can in no way be determined accurately. However, from a study of a volunteer, who went on hourly milk and cream feedings for twenty-one days, and took measured quantities of whole human blood at three-day intervals, it was found that approximately 60 c.cm. of blood would give a stool indisputably tarry in color and consistency.

During the four-year observation period there were 361 patients admitted to Cook County Hospital with a diagnosis of perforated peptic ulcer. The greatest number of perforations occurred in the fourth decade, whereas bleeding with perforation reached its highest incidence in the sixth decade, approximately twenty years after the incidence of the greatest number of perforations. Either general or localized arteriosclerosis is the most probable cause for this variation. One hundred and fifty-two perforated ulcers were found in the stomach and in this group there were 16 perforations accompanied by bleeding. In addition there were 188 perforated ulcers found in the duodenum, again with 16 bleeding perforations. Thus, of 361 patients with perforation 36 bled. Fourteen of the 56 patients with hemorrhage and perforation had a history of bleeding for from one to six days prior to perforation. In the majority of the patients the bleeding was determined by the character of the stool. A few patients, however, noted hematemesis. Nine patients had some bleeding from seven to fourteen days before perforation.

From this study the authors concluded that a patient with a known ulcer history who suddenly manifests signs of hemorrhage should be looked upon as presenting a graver complication of ulcer, i.e., perforation. SAMUEL J. FOGELSON, M.D.

Mabrey, R. E.: Intra-Abdominal Torsion of Appendices Epiploicæ. *New England J. Med.*, 1940, 222: 12.

The author presents 6 cases of torsion of the appendices epiploicæ (1 private case, and 5 from the records of the Massachusetts General Hospital since 1911). This brings the total number of reported cases to 52. There were 29 men and 23 women. The ages varied from twenty to seventy, the average age being thirty-five. Among the published cases there were 5 in which the condition was an incidental finding; in the others acute symptoms were present which necessitated operation. The most common lesion involving these appendages is twisting of the pedicle with resulting infarction. Diagnosis is difficult and rarely made pre-operatively, the usual diagnoses made are acute appendicitis, renal colic, acute diverticulitis, intestinal obstruction, and tubo-ovarian disease. Treatment consists of removal of the mass after careful ligature of the base of the appendage.

There have been 6 deaths among the cases reported in the literature. In 2 of these the torsion

was an incidental finding at autopsy, 1 patient having died of acute pancreatitis and 1 of cardiac failure. In 4 cases death was definitely related to torsion of an epiploic appendix. J. M. MORA, M.D.

Stone, H. B., and McLanahan, S.: Carcinoma of the Large Bowel: Surgical Aspects. *J. Am. M. Ass.*, 1939, 113: 2282.

The group of 233 cases upon which the accompanying statistics are based represents patients operated on by the authors over an eighteen-year period.

The operability rates affect the mortality rates, but the latter must not be viewed too critically in cancer surgery. The authors' operability rate for the large intestine was 71.2 per cent.

It is often justifiable to remove an operable obstructing lesion in the presence of visceral metastases. Before the operability of a tumor can be determined finally, it may be necessary, occasionally, to make a careful, discreet beginning of resection.

In addition to the usual palliative procedures for an inoperable tumor, precolostomy has been used frequently for low sigmoid or rectal growths and thereby in many cases the immediate formation of a fecal fistula has been obviated. A knuckle of sigmoid proximal to the growth is brought out through a short left McBurney incision and sutured to the skin. This maneuver need not interfere with the fecal flow, but is in effect the first stage of a sigmoidostomy. The second stage, consisting of an incision in the intestinal wall, can be performed in the near or distant future, when necessity dictates, or may never need be done at all.

The intestine can be cleansed safely and satisfactorily in the majority of cases without recourse to any kind of preliminary enterostomy. Acute obstruction, perforation, ineffective conservative measures, age, and associated diseases, however, may be indications for preliminary surgical drainage of the bowel and a two-stage procedure. A one-stage operation has been preferred whenever possible in this series.

While a variety of procedures are available for the colon, aseptic end-to-end anastomosis following an adequate resection has been the operation of choice. Seventy-one such procedures yielded a mortality of 11.2 per cent. Concomitant decompression in the absence of preliminary drainage should be employed occasionally.

Local excision of a solitary malignant rectal polyp not invading the rectal wall is sufficient, provided careful observation of the patient follows. Radical operation should be performed if and when invasion of the rectal wall is determined.

Abdominoperineal resection is the logical operation for carcinoma of the rectum, and in this series was carried out in one stage. Perineal resection has been used for low growths in patients who are poor risks. Instruction of the patient by his surgeon with regard to the care of his colostomy is of the utmost importance.

While only 56 per cent of the deaths are directly attributable to the operative procedure, the incidence of peritonitis is high enough to stress the importance of an aseptic type of anastomosis and the desirability for more frequent employment of concomitant bowel drainage. JOSEPH K. NARAT, M.D.

Wangensteen, O. H.: The Genesis of Appendicitis in the Light of the Functional Behavior of the Vermiform Appendix. *J.-Lancet*, 1939, 59: 491.

Leonardo da Vinci said that the supreme misfortune which can befall a man is for him to allow theory to outstrip performance. The author believes that the American surgeon has fallen a victim to this ill fortune in his dealings with appendicitis. Despite well developed operative technique, our mortality rate for this disease is one of the highest in the world. An intelligent solution of the problem cannot be effected so long as the origin of the disease remains such a problem.

By the study of a large number of human fetal and adult appendical specimens and those of many animals, an attempt has been made to verify or reject certain existing concepts of the anatomy and physiology of the vermiform appendix.

One or more mucosal folds, in nearly all of which no circular muscle fibers could be demonstrated, were found to overlie the appendical orifice in more than 80 per cent of the human cases studied. These folds either partially or completely obscured the orifice in 28.8 per cent of the adult cases but in none of the fetal cases. It is thought that they preclude the entry of intestinal contents into the appendical lumen but do not interfere with its emptying.

The existence of a sphincter muscle at the site of the appendicocecal union could not be proved. This union in all fetal appendices and in the majority of appendices from patients less than one year of age was of Treve's Type I, in which case the appendix constitutes the true center of the cecal apex and a funnel-shaped continuation of it. In all other specimens the Treve's Type III cecum predominated. In this type the site of appendicocecal union lies far medial to the left toward the ileocecal valve, because of the greater sacculation of the lateral aspect of the cecum.

The lymphoid tissue and glandular epithelium were found to parallel each other in growth and to exhibit their maximum development between the eleventh and twentieth years.

The luminal capacity of the appendix varied directly with the amount of pressure in the lumen. Normal appendices could not be ruptured by water pressures as high as 2.3 atmospheres immediately after excision. The presence of inflammation, however, decreases the strength of the appendical wall tremendously.

The resistance to luminal outflow was highest in the cases of acute inflammation, less in those of the interval type, and lowest in normal appendices. This resistance was found to persist after amputation of successive segments of the appendix, which is inter-

preted as an indication that resistance to the luminal outflow is a property of each segment of the appendix and is due to the resistance of its circular muscle fibers to distention.

Appendicostomies were done in a group of 17 cases, and the following observations were made:

1. From 1 to 2 c.cm. of fluid could be collected daily from an unobstructed opening.
2. Pressures as high as 60 cm. of water could develop in the presence of an unobstructed appendical lumen.
3. Bacteria injected into these openings did not give rise to symptoms.
4. A single bird shot placed in the appendical lumen was usually extruded into the colon or through the external stoma within from twenty-four to thirty-six hours.

Spectrographic studies of excised appendices following the administration of barium enemas showed retention of barium only in those specimens which had been visualized by roentgenological examination and removed within six days or less thereafter.

Proof of the secretory activity of the appendix was attempted by a study of the behavior of obstructed cecal appendages in animals and obstructed appendical lumina after appendicostomy in man. In many animals no evidence of secretory behavior could be demonstrated. The vermiform appendage of the rabbit was found to perforate quite regularly after from ten to fourteen hours of obstruction. In the chimpanzee from thirty-three to thirty-nine hours of obstruction were required. In man obstruction of an exteriorized appendix was usually followed by the development of a high intraluminal pressure, but the obstruction was released before perforation occurred. The highest sustained pressures were: for man, 126 cm. of water; for the rabbit, 136 cm.; and for the chimpanzee, 106 cm.

The fact that the fluid accumulating in the appendices of man, the rabbit, and the chimpanzee is a true secretion and not a filtrate is indicated by the high secretory pressure developed under conditions of obstruction, and by the fact that the intraluminal pressure is higher than the tissue tension in the substance of the appendical wall.

The fluid secreted was found to be thin and serous. That of man has a pH somewhat higher than that of the rabbit, which is usually distinctly alkaline, and was found to contain mucin, amylase, and erepsin. The true nature of this secretion and the cells from which it originates demand further study.

All of the varieties of appendicitis which are recognized by the pathologist were produced by obstruction of the appendical lumen in animals in which the vermiform appendages possessed the ability to secrete fluid, but not in those animals in which the cecal appendages did not exhibit a secretory process. Furthermore, in animals that manifest secretory pressure, no histological evidence of injury may be observed if this pressure be maintained at a low level by removal of the fluid. In the obstructed exteriorized appendix of man the histological picture of diffuse suppurative appendicitis was produced, but the obstruction was released before gangrene or perforation occurred.

Evidence from other sources has shown that bacteria may be present normally in the lymphoid tissue of the appendix. In the author's opinion, this fact, coupled with the anoxic effect of high (secretory) intraluminal pressure upon the tissue and the disseminating force of increased hydrostatic pressure, may well explain the effect of obstruction in aiding the development of infection.

The small lumen of the appendix, which exhibits normally a real resistance to outflow, may prevent substances which enter it from being extruded. It is probable that appendicoliths and swelling of the lymphoid tissue are the two most frequent causes of obstruction in man, but kinks, bands, retrocecal fixation, and strictures must also be considered.

Sufficient evidence is lacking to indicate that geography, diet, culture, or season is related to the origin of appendicitis.

That appendicitis is a public health problem is amply shown by its high place among the leading causes of death in this country. The public must be taught the dangers of catharsis, and the value of early medical advice for abdominal pain.

The author urges that the pathologists revise their opinion of the obstructive factor in the etiology of appendicitis, and that the clinicians make the indications for removal of this "Uriah Heep" of the abdomen more liberal. In this way we may hope to diminish the unnecessarily high mortality from the disease. EDWARD W. GIBBS, M.D.

Botsford, T. W., Hudson, H. W., Jr., and Chamberlain, J. W.: Pinworms and Appendicitis. *New England J. Med.*, 1939, 221: 933.

This paper discusses the relation of pinworm (enterobius vermicularis) infection of the vermiform appendix to appendicitis occurring in children. Only in the last forty years has any interest been shown in this subject. The material in this report consists of 71 cases in which pinworm infection was discovered in appendices removed at operation at the Children's Hospital in Boston from 1929 to 1939.

The pinworm is a small, white, round worm. The male measures from 2 to 5 mm. in length and the female from 9 to 12 mm. When young the worm lives in the small bowel but in the adult state it lives in the colon. The diagnosis of pinworm infection is made by finding the worms or ova in the stools, in anal scrapings, or under the fingernails. Pinworm infection is very common in children and a recent survey revealed that 18 per cent of the children harbored pinworms.

Recently there has been a marked increase in the number of appendices found to be infected with pinworms. This increase is due to more thorough search for the worms in the appendical contents; both a gross and microscopical search is essential. The female worm can be seen with the naked eye, whereas the smaller male worm cannot.

Acute inflammation and pinworm infection of the appendix cannot be regarded as different in any particular from acute appendicitis without pinworm infection. Some authors believe the parasites provide a mode of entry for pathogenic bacteria by burrowing into the wall of the appendix, and thus initiate true acute appendicitis. On several occasions the authors have seen pinworms sticking into the submucosa when the appendix was opened immediately after removal. The fact that patients complaining of recurrent bouts of abdominal pain and presenting pinworm infection in the appendix have been relieved completely of all symptoms following operation is strong evidence that the parasites must be responsible for the syndrome.

The clinical diagnosis of pinworm infection of the appendix cannot be made definitely. Eosinophilia is of diagnostic value when it is present. The majority of patients present the usual history and physical findings occurring in ordinary acute appendicitis.

Seventy-one of 1,343 appendices removed at the Children's Hospital in Boston were infected with pinworms. Twenty-six of the patients among these cases had acute appendicitis and pinworm infection, due to the presence of pinworms. Forty-five patients had no inflammatory change in the appendix but had pinworm infection. All were relieved by appendectomy.

The safest treatment of appendical symptoms due to pinworms consists of simple appendectomy.

JOHN W. NUZUM, M.D.

Carter, R. F., Slattery, L. R., and Hahn, R. C.: Adaptation of the Mikulicz Operation for the Right Colon and Rectosigmoid. *Ann. Surg.*, 1940, 111: 80.

The Mikulicz operation is advocated when removal of the lower 6 in. of the ileum, the cecum, the ascending colon, and about one-third of the transverse colon is indicated. The authors consider this procedure superior to the end-to-side enterocolostomy and repair of the raw surface on the posterior abdominal wall, because of the following reasons: (1) the best methods of joining the ileum to the colon and of repair of the raw surface are still under debate; (2) their method of repair of the raw surface on the posterior abdominal wall is adequate for the removal of the entire lymphatic area attached to growths in the cecum and ascending colon; and (3) prior to the use of this means for repairing this defect, the area could not be covered when an adequate drainage field was removed. The method is illustrated in the accompanying figure (Fig. 1).

Spontaneous closure of the fistula is enhanced by suture of the peritoneum close to the crushing clamps, so that the mucous membrane edges will tend to retract away from the skin edges when the clamps are removed. After the wound is closed and the crushing clamps are placed on the ileum and colon near the skin, formalin solution is injected into the exteriorized bowel to prevent deterioration of the specimen during the time it is left in place on the abdomen. On the second or fourth day the growth is removed, and a rectal tube is inserted into the ileum and held by a purse-string suture. The clamp on the colon is left in place to prevent intra-abdominal retraction.

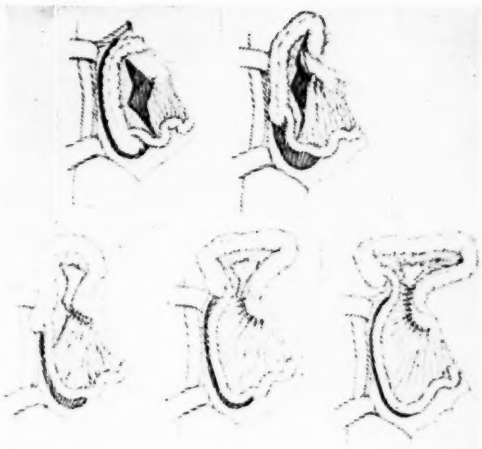

Fig. 1. Diagrammatic representation showing the method of suture of the divided mesentery of the ileum to that of the cecum and ascending colon. As these sutures are placed, the cecum and ascending colon are raised up and through the upper angle of the abdominal incision. The last suture approximates the serous surface of the lower ileum to the transverse colon. (Courtesy of J. B. Lippincott Co.)

After the colon-crushing clamp is removed, the stoma clamp is applied deeply, and a tight ligature is passed around the open ends of the ileum and colon, the rectal tube remaining in the ileum; the protruding ends of the colon and ileum are thereby strangulated by this ligature. Thus, the open margins lie near the level of the peritoneum when the stoma clamp comes free, greatly facilitating healing of the stoma without secondary closure.

The authors' last 3 cases have closed spontaneously in from eight to twelve weeks. The drainage of liquid feces is readily controlled in patients in whom there is primary union of the remainder of the abdominal wound. Adhesive tape is applied tightly across the edges of the wound over the open ends of the intestine.

The authors also describe their application of the Mikulicz procedure for resection of the sigmoid colon and rectum for carcinoma. It is a combination of the Miles resection and Kuttner's sacral anastomosis with preservation of the sphincters.

The abdominal portion of the operation consists of mobilization of the mesosigmoid, ligation of the trunk of the inferior mesenteric artery below the left colic artery, and mobilization of the rectum down to the levator ani muscles. The abdomen is then

closed temporarily and the patient placed in Sims' position.

The growth is then delivered through a sacral incision through which the coccyx is first removed. The Mikulicz clamps must be applied without undue tension on the circulation of the loops. The patient is then placed on his back, the abdomen is reopened, and the peritoneal pelvic floor is closed.

Three or four days later the growth may be removed, and the proximal opening is allowed to function as a sacral colostomy. The spur is crushed with an olive-tipped clamp after five or seven days.

The most important factor in the after-care is to promote voluntary closure of the sacral fistula. This is done best by keeping the margins of the mucous membrane away from the skin by packing the cavity with gauze. Operative freeing is necessary when the mucous membrane and skin unite. Attempts to close the fistula after the first three or four weeks have all resulted in a breakdown of the suture line. When this is attempted the sphincter must be divided.

The authors report 8 patients operated upon since 1934, with 1 death from peritonitis. The other 7 patients are free of recurrences and all have normal movements, although 3 have sacral fistulas. Two patients have had dilatations of the sphincter for stricture.

HAROLD LAUFMAN, M.D.

Midana, A.: The Anorectocolic Localizations of Nicolas-Favre Disease (Le localizzazioni anoretto-coliche della malattia di Nicolas e Favre). *Arch. ital. d. mal. dell' appar. digerente*, 1939, 8: 347.

Midana reviews the latest data on Nicolas-Favre disease, which reveal the extent of the pathogenic possibilities of the virus. Among the various localizations of the disease, those of the anorectocolic region deserve particular attention, because of the frequency of their occurrence and the gravity of their lesions; they should be called infiltrative rectitis because this term indicates the basic anatomicopathological aspect of the process. Macroscopically, the author distinguishes acute and chronic forms and divides the latter into hypertrophic vegetative and stenosing types. Among the complications, he insists on the formation of fistulas. Then he calls attention to the frequent association of the anorectocolic manifestations with the localizations of the disease in the internal and external female genital apparatus. The rectal lesions often spread to the colon and it is possible that some phenomena now included in the poorly known picture of ulcerating colitis should be referred etiologically to the virus of Nicolas-Favre disease. The author traces the histopathological picture of the lesions which in general corresponds to the well known one of the latter disease.

In his discussion of the cause of infiltrative rectitis, the author reviews the theories of the syphilitic, gonococcic, streptococcic, and tuberculous origin of the lesions and concludes that, on the basis of experimental, microbiological, clinical, histopathological, and therapeutic data, the majority of the cases of infiltrative rectitis are due to the virus of Nicolas-Favre disease and that other infectious agents, principally the tubercle bacillus, may cause a similar picture in only a very small percentage of cases. He admits that the various pathogenetic theories that have been proposed can be conciliated in the sense that the rectal wall may be attacked by the virus through direct inoculation of the mucosa, or through invasion of the nearby lymphatic territories with subsequent migration to the anorectal region and through a process of perirectal lymphocellulitis. The diversity of the pathogenetic mechanism is consequently related to the mode in which contagion has taken place and which varies according to the sex of the patient; hence, there are different varieties of rectitis.

The diagnosis is considered on the basis of the clinical, biological, roentgen, and rectoscopic data, and these various elements are evaluated. In the differential diagnosis, the acute and chronic forms, gonococcic and tuberculous rectitis, anorectal actinomycosis, and syphilis, as well as tumors, are considered. Discussion of the treatment includes chemical (antimony, iodine, sodium salicylate associated with antimony, sulfamides), biological, physical (roentgen, diathermy, mechanical dilatation, electrocoagulation), and surgical means; general treatment with chemical or biological substances has not fulfilled the hopes founded on it, but antimony seems to give the best results; local treatment is helpful; surgical treatment is indicated in rebellious and grave progressive cases.

Roentgen examination with an opaque enema reveals a more or less marked degree of reduction of the caliber of the rectal ampulla, usually associated with insufficiency of the sphincter; the rectum appears like a rigid tube with slightly dentate and ragged contours. The roentgen findings, although not pathognomonic like Frei's reaction, allow, nevertheless, a sufficiently precise diagnosis in the majority of cases. Stenosis of inflammatory origin differs from that due to tumors, which in general do not involve the entire ampulla but are circumscribed and reduce the caliber of the ampulla to a greater degree; stenosis due to tuberculosis may be as extensive as that caused by Nicolas-Favre disease. Roentgen examination also gives a good idea of the extent of the infiltrative process; this is particularly useful, as rectoscopy is impossible in most cases of rectitis due to this disease.

RICHARD KEMEL, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Quigley, T. B.: Biliary Surgery in the Aged. *New England J. Med.*, 1939, 221: 970.

The number of persons living beyond sixty-five years of age is increasing. Today they form 6.5 per cent of the population, or 8,400,000; in 1980 they will constitute 14.4 per cent, or 22,000,000. Of 100

consecutive patients over sixty-five years of age, who underwent biliary surgery at the Peter Bent Brigham Hospital, 29 had imperative need for surgery; in 71 surgery was elective. Of the first group, 10 died; of the 71, only 3 died. The imperative indications for surgery were acute cholecystitis and progressive jaundice. The causes of death were bronchopneumonia, cardiac failure, and sepsis. No death could be attributed to the anesthetic. A general discussion of management is given. PAUL STARR, M.D.

Rodinò, D.: Changes of Cirrhotic Type in the Liver Following Ligation of the Choledochus: Experimental Research (Sulle alterazioni a tipo cirrotico del fegato in seguito a legatura del coledoco: ricerche sperimentali). *Riv. di chir.*, 1939, 5: 369.

Experimental ligation of the choledochus has been performed by various authors, who have described a typical biliary cirrhosis as the result of the intervention. Rodinò reports his observations on resection of the choledochus between two ligatures because the hepatic lesions which he found were more severe than those observed by others and because in 2 of his experiments there was a marked degree of ascites which has not yet been reported after experimental occlusion of the choledochus. The 8 dogs which he used became rapidly and progressively jaundiced and survived the experiment from forty to ninety days. In the 2 animals which survived for the longest period, seventy-six and ninety days, respectively, he observed gradual swelling of the abdomen, and he was able to establish the presence of free fluid in the peritoneal cavity. At necropsy, about 6 liters of a limpid, pale yellow-green fluid, having the characteristics of a transudate, were found in these 2 dogs, while a small quantity of free fluid of the same nature was discovered in the abdomen of another dog which had survived the experiment for sixty days. All the abdominal organs were jaundiced, but appeared to be macroscopically healthy. The liver was slightly increased in size, intensely green, and harder than normal; section caused a slight grating sound and the framework of the organ was well in evidence. Histological examination revealed extensive new formation of connective tissue and the picture of real cirrhosis; in fact, the picture in the 2 dogs with marked ascites was identical to that of cirrhosis caused by biliary stasis. The greater severity of the lesions found in these animals was undoubtedly due to their longer survival and, as any effective influence of infection could be excluded, there remained only biliary stasis as the direct cause of the hepatic changes.

It is difficult to explain the mechanism through which the changes are produced, but it would seem that the first stimulation for the proliferation of connective tissue could be furnished by the extravasated bile. However, this would apply only to the initial stages, as the proliferation of connective tissue surrounding the biliary vessels would soon prevent or at least strongly decrease the passage of bile through the thickened vessels. It is also possible that the toxic condition of the liver caused by retention of the bile contributes to the production of the cirrhotic changes. The appearance of the ascites seems to be best explained by the presence of the new formation of connective tissue in the portobiliary spaces, which has inevitably caused a compression of the intrahepatic portal vessels with resulting stasis in the distal portal branches and consequent effusion of ascitic fluid in the peritoneal cavity; this seems all the more probable when one takes into consideration the fact that the ascites occurred only in the experiments of protracted duration in which the new formation of connective tissue and the cirrhotic changes were most advanced. There is no doubt that the greater severity of the changes observed by the author, as compared to those found by others in similar experiments, depended on the unaccountable fact of the protracted survival of his experimental animals.

RICHARD KEMEL, M.D.

Macfie, J. M., Bacharach, A. L., and Chance, M. R. A.: Vitamin-K Activity of 2-Methyl-1:4-Naphthoquinone and Its Use in Obstructive Jaundice. *Brit. M. J.*, 1939, 2: 1220.

The authors report their experiences in which they showed that 2-methyl-1:4-naphthoquinone was anti-hemorrhagic in chicks and in 4 patients with jaundice. They state that it may be given intramuscularly as well as by mouth. The prothrombin time became normal in forty-eight hours after the administration. PAUL STARR, M.D.

Ochsner, A., DeBakey, M., and Murray, S. D.: Amebic Hepatic Abscess: An Analysis of 139 Cases, with a Review of the Literature. *J. internat. chir.*, 1939, 4: 509.

A study of amebic hepatic abscess is presented, as based upon an analysis of over 5,000 collected cases and 139 of the authors' cases. During the ten-year period, from 1928 to 1937, inclusive, 186 cases of liver abscess were admitted to the Charity Hospital and the Touro Infirmary in New Orleans. Of this number, 47 (25.2 per cent) were pyogenic abscesses of the liver and 139 (74.7 per cent) were amebic. During this same period there were 540,776 total admissions to the Charity Hospital, among which there were 160 (0.029 per cent) abscesses of the liver and 1,152 cases diagnosed as presenting liver disease, of which 118 (10.2 per cent) presented amebic hepatic abscess and 42 (3.6 per cent) pyogenic hepatic abscess. The incidence of amebic hepatic abscess in all cases of amebiasis was found to be 4.7 per cent. This is based upon a group of 9,039 collected cases of amebiasis, including the authors', in which there were 430 cases of amebic abscess of the liver. Of 4,994 fatal cases of amebiasis collected from the literature, 1,818 (36.5 per cent) were found to present hepatic abscess. In the Charity Hospital in New Orleans, it was found that apparently the incidence of amebic hepatic abscess has increased during the past several years. Whereas, during the six-year

period from 1928 to 1933 there were 59 (15.2 per cent) cases of amebic abscess of the liver among 388 cases of amebiasis, during the four-year period from 1934 to 1937, inclusive, these respective figures were 59 (20.4 per cent) and 288. The sex incidence of amebic hepatic abscess revealed a preponderance of occurrence in the male, 95.3 per cent in the collected cases and 85.4 per cent in the authors' cases. There is no satisfactory explanation for the high incidence of amebiasis in the male. Amebic hepatic abscess occurs principally during adult life or in the most active period, few cases being observed in individuals less than twenty or more than fifty years of age. Whereas a number of observers from the tropics have expressed the opinion that Europeans are more susceptible to the development of amebic hepatic abscess than the natives, in the authors' series of cases no significant racial predisposition was found.

A succinct historical résumé of amebic hepatic abscess is presented.

The pathogenesis of amebic hepatic abscess is discussed. Whereas there are three possible routes by which amebæ may gain access to the liver, it is the consensus of most authorities that they reach the liver from the primary focus in the intestine through the portal vein. The two most significant pathogenic factors in the development of amebic hepatic abscesses are: (1) intrahepatic portal thrombosis and infarction caused by the amebæ, and (2) cytolytic activity of the amebæ. The amebæ are found in the zone of necrotic tissue adjacent to the outer dense fibrotic abscessed wall. They can be demonstrated with great frequency in the early stages of amebic hepatitis or in the marked necrotic tissue of early abscesses. They are rarely found in the old abscesses with thick fibrotic capsules. This probably accounts for the fact that amebæ are so difficult to find in the contents of large amebic abscesses, especially when first opened. In a collected series of 855 cases amebæ were demonstrable in the abscess contents of 324 (38 per cent). In the authors' series of 77 cases in which the results of this examination were stated there were only 12 (15.5 per cent) with positive findings. True amebic abscesses of the liver are characteristically bacteriologically sterile. Of 602 cases collected from the literature, 510 (84.7 per cent) were found to be sterile. In the authors' series of 77 cases, 65 (84.5 per cent) were sterile. The most frequently found organisms in the secondarily infected abscesses are staphylococci, streptococci, and colon bacilli.

The gross and microscopic characteristics of amebic hepatic abscess are described. The abscess may be multiple or single and usually involves the right lobe. In a series of 1,609 cases collected from the literature, 1,048 (65.1 per cent) were single and 561 (34.9 per cent) were multiple abscesses. In the authors' series of 99 cases these respective figures were 87 (87.8 per cent) and 12 (12.1 per cent). In a collected series of 2,121 cases the right lobe was found to be involved in 1,792 (84.4 per cent) and the left lobe in 329 (15.5 per cent). In the authors' series of 99 cases there were 95 (95.9 per cent) in the right lobe and 4 (4 per cent) in the left.

In general, the clinical manifestations of amebic hepatic abscess may be divided into two groups: (1) systemic and (2) local. Of the former, fever is undoubtedly the most frequent. In the authors' series of cases, fever was present in 83.4 per cent. Other systemic manifestations are weakness, loss of weight, anorexia, nausea, vomiting, chills, profuse perspiration, and sallowness, or even jaundice. It is the general impression that diarrhea as either an antecedent or an accompanying manifestation occurs with significant frequency in amebic hepatic abscess and that it and amebic dysentery are generally confused. It should be thoroughly realized that amebic hepatic abscess occurs in a relatively large number of patients who have never had a previous diarrhea. This fact, significant in the diagnostic consideration of amebic abscess of the liver, has been emphasized repeatedly by the authors. That this is not unduly exaggerated is demonstrated irrefutably by the fact that in a series of 654 cases collected from the literature only 374 (56.6 per cent) or a little more than one-half had a positive history of antecedent diarrhea. In the authors' series this incidence was 66.6 per cent, whereas diarrhea was a symptom at the time of admission to the hospital in only 21.5 per cent. Of the local manifestations of amebic hepatitis, pain and tenderness in the region of the liver are probably the earliest and most constantly encountered. In the authors' series these were the most constant manifestations in 84.8 per cent of the cases. Enlargement of the liver is another frequent sign and in the authors' series of 139 cases, this occurred in 71.9 per cent.

The average leucocyte count in the authors' series was 14,500, the polymorphonuclear percentage was 78, the erythrocytic count was 3,700,000, and the hemoglobin percentage was 65. The leucocyte count was found to vary somewhat and depended upon the age of the process and the presence or absence of secondary infection. In general, as the lesion becomes more chronic, the leucocyte count diminishes.

Roentgenography is one of the most important and dependable diagnostic laboratory procedures in amebic hepatic abscess. In the authors' series there were 114 cases in which roentgenological studies were made with positive diagnoses in 101 (88.5 per cent). Characteristically, there is elevation in and immobility of the right leaf of the diaphragm. A distinct bulging of the diaphragm may be observed pointing upward into the lower lung field. If there is an associated subphrenic abscess there is a characteristic obliteration of the cardiophrenic angle in the anteroposterior roentgenogram and the anterior costophrenic angle in the lateral view.

Amebic hepatitis and hepatic abscess are not diagnostically difficult if the conditions are borne in mind and the clinical manifestations and laboratory investigations accorded due consideration. An amebic hepatitis should always be considered in a patient presenting a low grade daily remittent or

intermittent fever, pain and tenderness over the hepatic area, moderate leucocytosis, and endameba histolytica in the stools. The presence of an antecedent dysentery is confirmatory evidence but its absence is not refutatory. The diagnosis is further supported by a mild leucocytosis without a disproportionate increase in polymorphonuclear leucocytes. If, in addition to such a clinical picture, the characteristic fluoroscopic and roentgenological findings previously described are present, the diagnosis of liver abscess is justified. A positive diagnosis may be made if the active or encysted forms of endameba histolytica are found in the stools. The diagnostic importance of exploratory aspiration lies in the fact that characteristic chocolate sauce pus obtained in this manner is pathognomonic and definitely establishes the diagnosis of amebic hepatic abscess. The technique of aspiration is described and illustrated.

The prognosis in amebic hepatic abscess depends upon the multiplicity of the lesions in the liver, the presence or absence of complications, the presence or absence of secondary infection, and the type of therapy employed. Whereas of 12 cases in the authors' series with multiple abscesses all ended fatally, in 87 cases of single abscess there were only 10 (11.4 per cent) deaths. In 33 cases with complications the mortality rate was 39.4 per cent as contrasted with 8.4 per cent in 106 cases without complications. The avoidance of secondary infection in amebic hepatic abscess is paramount. Open drainage of such an abscess which is relatively sterile is invariably followed by secondary infection. It is possible to evacuate the abscess and simultaneously maintain its sterility only by closed drainage, i.e., aspiration. Whereas in a series of 4,880 cases collected from the literature in which open drainage was used there were 2,112 (45.3 per cent) deaths, in a similarly collected series of 457 cases in which closed drainage was used there were only 31 (6.7 per cent) deaths. The corresponding mortalities in the authors' cases were 21.6 per cent and 3.6 per cent.

The treatment of amebic hepatic infection is entirely surgical but may consist of either conservative or radical measures. By the former is meant the administration of the specific drug, emetine hydrochloride, with or without aspiration. The technique of aspiration is described. In those cases in which secondary infection was found, as demonstrated by smear and culture, open drainage was usually necessary. Under these circumstances it is imperative to institute the type of drainage which completely avoids the slightest possibility of contamination of the two virgin serous surfaces, i.e., the pleural and the peritoneal. The results obtained in the authors' series of cases clearly demonstrate this fact. Of 23 cases drained transpleurally 7 (30.4 per cent), and of 22 cases drained transperitoneally 6 (27.2 per cent) ended fatally. In contrast to these high mortality rates is the 7.9 per cent mortality obtained in 13 cases in which an extraserous approach was used.

The most frequent complications of amebic hepatic abscess are usually the result of rupture or the direct extension of the abscess into one of the adjacent viscera. In the authors' series, pleuropulmonary complications occurred in 15.1 per cent, peritonitis in 7.9 per cent, and pericarditis in 0.7 per cent. The various types of pleuropulmonary complications are briefly described and discussed.

Walton, Sir J.: Congenital Diverticulum of the Common Bile Duct. *Brit. J. Surg.*, 1939, 27: 295.

The pathological changes in all the reported cases of congenital diverticulum of the common bile duct, as well as in the 6 cases reported by the author, are remarkably alike, and consist of the presence of a cystic dilatation of that portion of the common bile

Fig. 1. Enormous dilatation of bile-ducts, commencing 3 cm. above ampulla of Vater. The dilatation formed an almost spherical cyst 9 cm. in diameter with a thick dense wall ⅓ cm. thick. Mucosa bile stained with many large shallow ulcers. Active opening between anterior surface of cyst and duodenum 6 cm. beyond pylorus. Great dilatation and thickening of both hepatic ducts, moderate dilatation of cystic duct, and slight dilatation of gall-bladder. All these ducts opened into the cyst by constricted orifices. No dilatation of intrahepatic ducts. Lower portion of common duct opened obliquely at a very acute angle into the dilated sac by a narrow orifice just admitting a fine probe, the orifice being situated on the anterior wall about 1 cm. above the lowest part of the sac. The duct below showed no obstruction and no dilatation. No dilatation of pancreatic duct.

duct lying above the duodenum (Fig. 1). The cyst, although more or less spherical, is always eccentric and differs entirely from the uniform dilatation of the duct seen above an obstruction. When the cyst is opened, the orifices of the common duct and the hepatic duct are seen to be in line on the inner surface, and often, indeed, lie at the ends of a shallow groove. The cyst is, in fact, more like a saccular than a fusiform aneurysm. Hence the term, "congenital diverticulum" is more correct than "congenital cystic dilatation."

The diverticulum lies behind and above the duodenum, and as it enlarges it spreads upward to the liver, outward toward the right renal fossa, and downward to the pelvis. The duodenum is usually pushed downward and inward, but may be stretched and flattened over the surface. The enlarged cyst, however, may come to be in front of the duodenum. The hepatic flexure is pushed downward and outward. At operation, the diverticulum may vary in size from that of a tangerine to a swelling which passes right down to the pelvis and is mistaken for an ovarian cyst or an advanced pregnancy.

Distally, the pathological change seems to be sharply limited to that portion of the duct which is above the duodenum, but its superior termination is less constant. Generally, there are two openings above, that of the common hepatic and that of the cystic duct; that is to say, the common hepatic duct does not participate in the diverticulum. In other cases, there are three openings, the common hepatic duct being involved and the two hepatic ducts opening separately into the cavity.

The contents of the sac is usually thin bile-stained fluid, the quantity of which varies greatly, from a few ounces to several pints. The sac may even contain several liters. If there is nearly complete obstruction, the bile is likely to be white. If, however, there is free communication with the gall bladder, the concentrating function of this viscus may cause the bile to become thick and viscid. In some cases the bile is infected. It is unusual to find calculi present.

In the majority of the reported cases it was noted that the wall of the diverticulum was thick and fibrous, but in a few it has been described as thin and very friable, so that it ruptured on manipulation. The lining may be epithelial; in some cases the mucosa is absent, and in others there is much ulceration.

The ducts above, whether common hepatic or separate, are as a rule greatly dilated, but this dilatation is cylindrical and is in no way a part of the saccular diverticulum. In some cases the ducts may be only slightly dilated or even normal in diameter.

It is remarkable that in the greater number of cases the gall bladder is of normal size, even if the lower part of the cystic duct be dilated. However, cases have been reported in which there was marked dilatation of the gall bladder.

The common duct below the diverticulum usually opens into the sacculation by a narrowed opening. As a rule, the narrowing does not extend down to the ampulla, and the pancreatic duct is unaffected. Many authors lay stress upon the fact that the opening is high up on the inner side of the diverticulum and is guarded by a valve-like fold of mucosa.

As the diverticulum enlarges it may cause pressure. The duodenum is not uncommonly flattened over it and somewhat dilated, and in some cases duodenal ileus may occur. In marked contradistinction to congenital obstruction of the common bile duct and carcinoma of the ampulla or head of the pancreas, the obstruction from the diverticulum seems to affect the liver but little. However, mild cirrhosis or hepatitis may occur. In some advanced cases, on the other hand, there is ascites and enlargement of the spleen. The ascites may be dependent upon cirrhosis of the liver, or, as would appear to have been the cause in one of the author's patients, pressure upon the portal vein. In this case there was no true cirrhosis, but the portal, splenic, and superior mesenteric veins were thrombosed.

Eighty per cent of the cases of congenital diverticulum of the common bile duct have occurred in females. Most of the patients have been relatively young and have often had a prolonged history. However, the condition has been noted in patients as young as five weeks and as old as fifty-six years; the latter patient, however, had had a tumor for twenty years. No true hereditary history has ever been found.

The cause of the diverticulum has led to much discussion. It is, however, almost certain that the primary cause is not a congenital or acquired obstruction, for the dilatation is entirely unlike that caused by all the known obstructions, such as impaction of a stone in the ampulla, carcinoma of the ampulla or head of the pancreas, and chronic pancreatitis, the dilatation in these cases being uniform or fusiform. Although obstruction may be a secondary factor and may increase the size of the swelling, it would seem probable that the diverticulum itself is due primarily to a congenital anomaly. This is perhaps dependent upon the presence of a small congenital weakness in the lateral wall of the duct which may arise at the site of an accessory duct and is at first dormant. As it increases in size, however, like a saccular aneurysm, the lower part of the duct becomes obstructed, and this in turn leads to greater pressure upon the diverticulum until in time symptoms are produced.

The symptomatology varies greatly, but the patients would appear to belong to three groups with regard to clinical manifestations: (1) those with a large tumor; (2) those with pain and jaundice; and (3) those with an acute abdominal condition with pain, tenderness, vomiting, and rigidity. These groups are not sharply defined, however, and it is perhaps the combination of the different symptoms which should help in making a diagnosis.

Since the evidence is so definite that the condition is progressive and that all patients left unoperated upon appear to die ultimately of the lesion, operative

treatment should be undertaken. Since the cyst is found at operation to be firmly bound to the duodenum, which is often stretched over it, it becomes an extremely easy measure to make adjacent openings and perform a lateral choledochoduodenostomy, this procedure giving free passage for the contents of the diverticulum to the duodenum.

The author reports 6 new cases of congenital diverticulum of the common bile duct. Five of these were diagnosed at or before operation, and in 4 of them operative recoveries are recorded. The other case was discovered in a study of post-mortem records, and had not been recognized before death.

SAMUEL H. KLEIN, M.D.

Pribram, B. O. C.: Cholecystocholedochostomy: An Attempt to Preserve a Functioning Gall Bladder When Operating. *Lancet*, 1940, 238: 68.

The author believes that a malfunctioning gall bladder, especially when stasis of bile is the main trouble, but with a normal wall should be preserved when possible. Such stasis may be due to a long and tortuous cystic duct with kinks, or to a ptosis of the gall bladder causing difficulty in its emptying. Neither conservative measures nor cholecystectomy has been satisfactory in this type of case. The author advocates cholecystocholedochostomy to overcome the obstruction to the emptying of the gall bladder. This is preferable to cholecystogastrostomy or cholecystoduodenostomy in cases of biliary stasis, these procedures being reserved for inoperable obstruction of the common duct. The most logical procedure when stasis is due to an obstacle in a bent cystic duct is an anastomosis between Hartmann's pouch and the common duct.

It is essential that the field of operation be widely exposed. The author prefers a costal incision. The gall bladder is punctured at the fundus and its contents are aspirated; it is then irrigated with salt solution. The fundus is opened further to permit examination of the mucosa and a finger is introduced to palpate for stones. Next the hepatoduodenal ligament is incised over the common bile duct. The common duct is opened for from 1 to 1½ in. and calculi, if present, are removed. The gall bladder is opened in the most suitable location for the anastomosis. A stay suture is fixed at each end of the planned anastomosis and traction on these facilitates the posterior half of the anastomosis. A small drain with one or two side holes at the end is introduced into the fundus of the gall bladder and this passes through the anastomosis into the common duct down to the papilla of Vater. The drain must be small enough to permit bile to flow around it into the common duct. The anterior portion of the anastomosis is completed over the drain. Sometimes no drain is used and, if so, the fundus of the gall bladder is tightly sutured. A safety drain is always placed outside of the gall bladder near the site of the anastomosis.

The author has performed cholecystocholedochostomy not only in cases of simple biliary stasis

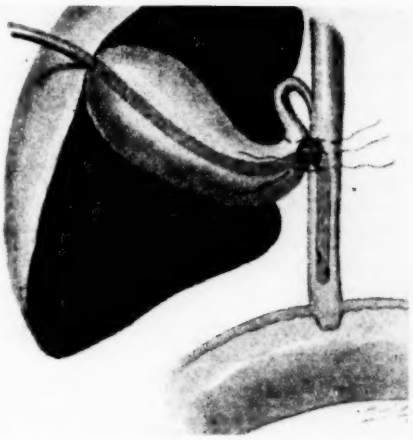

Fig. 1. Cholecystocholedochostomy for biliary stasis.

but also when gall stones were found in a still functioning gall bladder. Thirty-two cases have been operated upon in this manner with one death from pneumonia. Since the first operation was performed only six years ago it is too early to draw conclusions as to permanent results. The author is well pleased with his results to date. The patient's appetite immediately improves. However, all patients were not relieved of their symptoms and later cholecystectomy still failed to give relief. The stoma has remained patent in patients who were subjected to subsequent biliary surgery.

EARL O. LATIMER, M.D.

Bachrach, W. H., and Fogelson, S. J.: Choledochojejunostomy. *Surgery*, 1939, 6: 882.

The authors resected seven-eighths of the stomach and the entire duodenum of dogs. The original purpose of the experiments was to determine if pernicious anemia would occur subsequent to such removal of the duodenum and almost the entire stomach. They found that the blood picture was not altered and further observed the effect of choledochojejunostomy on the liver and gall bladder.

After trying to anastomose the gall bladder to the jejunum this procedure was abandoned in favor of choledochojejunostomy. The procedure of the anastomosis was simplified by drawing the common duct through a stab wound in the jejunum and retaining it by one stay suture brought through the wall of the jejunum about 1.5 cm. away from the puncture wound. No sutures were used about the puncture wound in the jejunum through which the common duct entered the bowel. A Pólya type of anastomosis was made between the stomach and jejunum. Seven animals lived from one and three quarters to two and three quarters years, being sacrificed at that time.

The essential findings in this study were: (1) the persistence of a normal blood picture, (2) moderate dilatation of the biliary tree with no obstruction of the distal end of the common duct, (3) no significant microscopic evidence of active gall-bladder infection, (4) no histological evidence of liver infection or liver damage, and (5) the excellent condition of the animals throughout the study.

The results of these experiments tend to confirm the contention of Wangensteen that not the site but the size of the biliary anastomosis is of major importance. If the anastomotic opening of the biliary tree to the gastro-intestinal tract remains persistently patent with an orifice sufficiently large to give adequate drainage there follows a minimum of stasis with limited ascending infection and little or no liver infection or damage. EARL O. LATIMER, M.D.

Zschau, H.: The Late Results of Injuries to the Spleen (Ueber Spaetfolgen bei Milzverletzung). *Arch. f. klin. Chir.*, 1939, 195: 738.

It is known that injuries to the spleen will not always lead immediately to threatening symptoms. The patient may have no special symptoms for days, weeks, or months, when suddenly late hemorrhage may occur. The interval of time is seldom more than eight days, but there have been cases reported in which nineteen, twenty-nine, and even one hundred and eighty-six days have elapsed before onset of the bleeding. In the interval some of these patients are symptom-free and able to work; others complain of vague pains, often after meals. Fifty such cases of late hemorrhage have been reported. It has been only in the last few years that Kunen has demonstrated that in two-thirds of the cases there is generally a subcapsular hematoma and late hemorrhage occurs when the capsule is torn. In only one-third of the cases a primary tear of the capsule and of the splenic pulp occurs. In these cases late hemorrhage can be ascribed to dissolution of the clot or separation of abdominal adhesions. The author believes that changes in the volume of the spleen resulting from ingestion of food may be sufficient to rupture the capsule when a subcapsular hematoma is present. But not all injuries to the spleen lead to massive hemorrhage; more tears of the spleen heal spontaneously than is suspected. The scars are considered to be from infarcts. The author reports 3 unusual cases:

Case 1. A thirty-year-old man who was riding on a motorcycle was struck by the left handlebar when he collided with another vehicle. A fracture of the olecranon process resulted. He noted slight pains in the region of the left costal margin. Seven days later after eating a meal he turned around suddenly, experienced severe abdominal pain, and collapsed. At operation, which was done with the pre-operative diagnosis of a perforated peptic ulcer, 1¼ liters of fluid blood were found in the peritoneal cavity and a 6 cm. tear was found in the spleen. The spleen was removed and the patient recovered.

This was a case of a one-sided tear with delayed bleeding. Near the tear a hemorrhagic infarct measuring about 2:1.5 cm. was found. On both sides of the tear there was bleeding into the splenic pulp.

Case 2. A seventeen-year-old youth hit himself in the left upper quadrant with his elbow while doing gymnastics. He felt faint and had slight pain. He remained in good condition and was discharged on the fourth day. On the fifth day he suddenly experienced severe pains in the splenic area and collapsed. He was again taken to the hospital. There was protective tension in the left upper quadrant. The hemoglobin was 60 per cent; respirations were rapid; and the temperature was 38.5 degrees. A blood transfusion of 300 c.cm. was given and the hemoglobin was checked every hour. The condition improved and operation was deemed unnecessary. After about six weeks the patient was discharged with practically normal hemoglobin. He has remained well since.

Case 3. A twenty-eight-year-old man was thrown from a motorcycle against a road marker. He sustained a concussion of the brain, a severe contusion of the left abdomen, left kidney, left thorax, and left side of the neck. Pure blood was noted in the urine. On the fourth day there was great difficulty in breathing and a right pneumothorax and left hematothorax were found. On several occasions from 800 to 1,000 c.cm. of air was aspirated from the right chest, and from 150 to 300 c.cm. of blood was removed from the left chest from between the eighth, ninth, or tenth ribs. In addition to these injuries the patient also had a laceration of the cervical and brachial plexuses and a fracture through the glenoid cavity of the scapula. On the twenty-first day the temperature rose and aspiration revealed pus from which the hemolytic staphylococcus albus was cultured. Roentgen examination revealed a left subphrenic abscess. On the fifty-third day the tenth rib on the left side was resected. The costophrenic angle was found to be obliterated and a large abscess was encountered which extended to the midline and superiorly to the level of the fifth rib. The spleen, which was torn into two parts, was found here; it was partly necrotic and the lower portion was fixed to the lateral abdominal wall near the tenth rib. This was allowed to remain in this position. Drainage was instituted and healing occurred in five weeks.

Subphrenic abscess rarely develops after injury to the spleen. The left leaf of the diaphragm was paralyzed as a result of the tearing of the phrenic nerve. Why a fatal hemorrhage from the spleen did not occur is hard to understand. Probably adhesions already existing about the spleen prevented this. A similar case has been reported by Karewski.

(FRANZ). JOHN A. GIUS, M.D.

MISCELLANEOUS

Lam, C. R.: Intra-Abdominal Pressure: A Critical Review and an Experimental Study. *Arch. Surg.*, 1939, 39: 1006.

Previous writers have commented on the confusion which exists on the subject of intra-abdominal pres-

sure. Some writers state flatly that the intra-abdominal pressure is negative; others, that it is positive, atmospheric, or variable. Statements, to be of significance, must define the exact region of the abdomen under consideration and the posture of the body. Thus the statement, "With the subject standing, the intra-abdominal pressure at the left internal abdominal ring was 25 cm. of water," is one of significance.

The author reviews the conflicting literature on the subject and proceeds to describe his experimental method of implanting a small rubber bag into various regions of the abdomen. The bag was connected to a water manometer by means of a small rubber tube. The bag held about 7 c.cm. of air without the development of intrinsic pressure. When a determination of pressure was to be made, the bag was emptied by suction and partially inflated with 4 c.cm. of air, after which connection with the manometer was made. Thus, both positive and negative pressures were indicated. The intra-abdominal pressure was varied by inflation of the alimentary tract with air, by creation of a tension pneumoperitoneum, and by changing the position of the animal. In most situations the pressure was slightly positive (from 2 to 19 cm. of water), but with the animal erect or head up, it became slightly negative. In regard to tension pneumoperitoneum, considerable increase in the volume of the abdominal contents is tolerated before tension develops, because of reflex relaxation of the abdominal wall. No direct measurements of the intra-abdominal pressure in man were made. On the basis of these animal experiments and the work of others, it is probable that in an adult subject in the standing position there is a pressure of from 25 to 40 cm. of water in the lower part of the abdomen and in the pelvis. AUGUST JONAS, JR., M.D.

Balice, G.: Abdominal Drainage in the Removal of Acute, Perforated, or Gangrenous Appendices (Il drenaggio addominale nelle appendiciti acute perforate e cancrenose). *Policlin.*, Rome, 1939, 46: sez. chir. 461.

The author reviews recent opinions on the advisability of drainage in cases of acute appendicitis with peritoneal involvement. Basing his concept upon clinical and experimental studies reported in the literature as well as upon his own experience, Balice considers a drain, be it of gauze, rubber, or glass, as a foreign body introduced into the abdomen which tends to evacuate a limited area for a brief interval, at best from fifteen to eighteen hours, stimulating in the meantime the usual foreign body reaction which results in the formation of adhesions and a process of walling off. With this concept in mind, he suggests the following conditions as indications for the use of drainage: when adequate peritonealization has not been possible; when reliable hemostasis has not been achieved by instrumental means; when an infected organ may not be removed; and finally, when the eruption of infected material into the peritoneal cavity is to be feared. In brief, Balice advocates the use of a drain not for the primary but for the secondary situation.

He reports 12 cases of appendicitis, in which the duration of acute symptoms varied from two to six days. In all cases the appendix was found to be perforated or gangrenous, and infection, involving the peritoneum in a more or less circumscribed process, was present. In all cases the abdomen was closed after the removal of the appendix and the evacuation of the abscess, and primary healing was invariably obtained. In this category of cases, the author believes that drainage is not only ineffectual but detrimental. EDITH FARNSWORTH, M.D.

GYNECOLOGY

UTERUS

Dannreuther, W. T.: The Treatment of Retrodisplacements of the Uterus. *J. Am. M. Ass.*, 1939, 113: 1609.

The term retrodisplacement is used clinically to include both retroversion and retroflexion, although literally it implies a backward dislocation of the uterus irrespective of its relation to the vertical plane of the pelvis. A retroflexion differs from a version only in the break in alinement at the cervicocorporeal junction, and a distinction between the two is of only academic interest. Both alterations in position may be congenital or acquired; neither causes symptoms *per se*, and the treatment of each is the same. Retroversioflexions complicated by prolapse in the axis of the vagina constitute a separate problem and are not under consideration.

Upon recognition of a retrodisplacement, it becomes important to ascertain whether the malposition is congenital or acquired, whether the uterus is replaceable or immobilized, and whether or not there is coexisting endocervicitis, parametritis, periuterine fixation, adnexal disease, or pelvic tumor. Developmental defects require no corrective therapy. A replaceable uterus may be treated expectantly, with a pessary or by operation. Immobilization is usually due to associated pathological conditions. A freely mobile retrodisplacement is often erroneously regarded as uncomplicated simply because no grossly apparent complications can be detected, although there may be intense concomitant passive congestion. It is the insidious onset of circulatory stasis that is responsible for the delayed and gradual appearance of symptoms in the majority of cases. As the vascular engorgement increases, the walls of the veins weaken to such an extent that actual varicosities may be seen at the operating table.

Of the many complaints credited to retrodisplacement only three, sacral backache, a sense of pelvic heaviness, and leucorrhea, are apt to be manifestations of the malposition itself. However, there are so many additional causes of these three complaints that the mere existence of a displacement does not justify the assumption of direct cause and effect.

If a sacral backache can be relieved by such measures as unloading an obstipated colon, treatment of posterior parametritis, fitting flat-feet with suitable plates, eradication of remote foci of infection, and orthopedic treatment to remedy abnormalities in the lower part of the spine even though a displacement persists, the time to discover this is before a futile laparotomy and not afterward. In other words, the major problem is not the recognition of a retrodisplacement, but the differential diagnosis of the true source of the symptoms attributed to it.

Proper precautionary measures following abortion, labor, and vaginal operations involving traction on the cervix will prevent many acquired malpositions. After therapeutic abortion, packing of the uterus with idoform gauze for forty-eight hours and the administration of 1 c.cm. of solution of extract from the posterior lobe of the pituitary gland twice daily for three days will hasten involution. After delivery, perineal lacerations should be repaired immediately. Elevation of the patient's shoulders on the second day promotes free lochial drainage, and by her assuming the prone position for five or ten minutes several times each subsequent day forward gravitation of the uterus is facilitated. Deep breathing exercises in the knee-chest position help to prevent diastasis of the abdominal muscles and also tend to throw the corpus forward. Regular and continued breast feedings reflexly stimulate pelvic involution. If all patients are re-examined three, six, and twelve weeks after abortion or parturition, retrodisplacements will be detected promptly. It is also important to replace the uterus bimanually and hold the cervix back in the pelvis with a strip gauze vaginal pack, which is pressed firmly against the portio, after operations such as curettage and trachelorrhaphy, which necessitate pulling the uterus into the vaginal plane.

Some freely mobile retroversions of long standing are found to be symptomless and to require no treatment. If such a displacement is of recent origin, one year or less, the uterus should be held in its normal position for several months with a pessary and not treated expectantly.

Palliative therapy resolves itself into the application of a pessary in cases of replaceable retrodisplacement, and the treatment of coexisting parametritis and adnexal disease when the uterus is thereby immobilized. When the malposition is discovered early it can be corrected with an excellent prospect of a non-operative cure; in other cases relief is experienced only so long as the pessary is worn. The purpose of a pessary is not to correct a displacement but to maintain proper uterine poise after the uterus has been replaced. Misused, misfitted, and misapplied pessaries will cause distress and local soreness, whereas one that is fitted accurately can be worn with perfect comfort.

Laparotomy for the correction of a displaced uterus is an elective and not an emergent procedure, and it should not be advised unless the hazards involved are minimal, all palliative measures have been exhausted, and subsequent pelvic comfort can be anticipated. An operation which fails to afford symptomatic relief is a failure.

The author's experience is summed up in the accompanying tables.

The multiplicity of operations devised for the surgical replacement of a retroverted or retroflexed uterus is evidence that no single technical procedure is universally applicable. Dannreuther favors the

Baldy-Webster operation whenever it can be judiciously selected. It is ideal for the patient who has worn a pessary with relief of symptoms. He believes that it is contraindicated when the round ligaments are markedly attenuated or whenever concomitant adnexal disease necessitates salpingo-oophorectomy. The relatively high incidence of such disease accounts for the relatively small number of Webster operations in the series.

TABLE I—RETRODISPLACEMENTS OF THE UTERUS IN A SERIES OF 3,400 CONSECUTIVE OFFICE PATIENTS[1]

	Number of Cases		Approximate Percentage of Cases
	Congenital	Acquired	
Developmental retroversions	72	..	19
Symptomless acquired malpositions	..	47	12
Relieved by treatment of complications	..	50	13
Relieved by pessary	..	76	20
"Uncomplicated" retrodisplacements: patient operated on after wearing a pessary	..	28	7
Primary corrective operation or operation after palliative measures failed	..	87	22
Hysterectomy for tumors (displacement of secondary importance)	..	27	7
	72	315	
Total		387	100

[1] Exclusive of 42 who failed to subject themselves to treatment.

TABLE II—SURGICAL PROCEDURES FOR RETRODISPLACEMENT OF THE UTERUS IN 2,550 CONSECUTIVE PELVIC OPERATIONS[2]

Type of Procedure	Number of Cases
Baldy-Webster suspension	80
Crossen-Gilliam	160
Ventrofixation	28
Mann plication of round ligaments	12
Olshausen suspension	5
Coffey plication of round and broad ligaments	1
Total	286

[2] Exclusive of operations for displacements associated with tumors.

When salpingo-oophorectomy is performed the author prefers Crossen's modification of the Gilliam operation. Both of these operations cause little trouble in the event of subsequent gestation and delivery.

A ventrofixation of the uterus was performed 28 times in women past the menopause when the round ligaments were so short and thick that they could not be conveniently plicated and when the rapid removal of adnexal masses after extensive vaginal work was so easy that hysterectomy did not seem warranted.

Olshausen's suspension tends to immobilize the uterine fundus and thus interfere with proper bladder expansion. DANIEL G. MORTON, M.D.

Micale, G.: Research on the Influence of the Contraction of the Uterine Muscle in the Determination of the Hyperbilirubinemia of Labor (Ricerche sull' influenza della contrazione muscolare uterina nel determinismo dell' iperbilirubinemia del travaglio di parto). *Riv. ital. di ginec.*, 1939, 23: 13.

Micale has determined the red-cell count, the amount of hemoglobin, the globular value, the globular resistance, the qualitative and quantitative blood bilirubin, and the alkali reserve of 25 healthy women who had never suffered from liver disorders. These tests were made before the end of pregnancy, during labor, and four hours after labor. The blood studies were made by the usual methods; the qualitative bilirubinemia was investigated by the method of Hymans von der Berg, the indirect, the direct rapid, and the direct retarded reactions being distinguished; the quantitative bilirubinemia was determined by the new method of Chabrol, Charonnat, and Busson, and the alkali reserve by the method of Van Slyke.

The number of red cells varied from 2,480,000 to 5,000,000 at the end of pregnancy, from 3,030,000 to 4,500,000 during labor, and from 2,920,000 to 4,400,000 four hours after labor. The hemoglobin values were regularly reduced to from 70 to 75 per cent, with a minimum of 45 per cent. The globular value during pregnancy and labor was generally less than 1, and reached a minimum of 0.71; but in some cases it was higher than 1. The globular resistance varied between 4 and 3, with a marked prevalence of 3.5.

During pregnancy, the bilirubinemia was increased, being between 10 and 12 mgm., with a maximum of 20 mgm. in some cases. The reaction of Hymans von der Berg was regularly positive in the indirect variety only, this fact indicating that the excess of bilirubin was the result of an exaggerated hemolytic process and that the liver was still functioning well notwithstanding the great increase in its activity required by the pregnancy. During labor, there was a decided increase in the bilirubinemic rate, which reached its height during delivery and ranged from 19.80 to 30 mgm. Four hours after labor, the rate was decreased, but not constantly, the lowest figure being 15 mgm. The excessive production of bilirubin during labor cannot be referred exclusively to hemolysis; besides, the direct retarded reaction of Hymans von der Berg was positive and weak in most cases, which indicated another cause for the excess of bilirubin. Various suggestions have been made as to the cause of the hyperbilirubinemia, but the author thinks that the contraction of the uterine muscle is an important factor, all the more so as recent studies have revealed an increase in bilirubinemia as a result of sports activity and of muscular fatigue in general.

The author has not tried to obtain measurements of the muscular fatigue during labor, but he has

determined the alkali reserve as an index of the degree of fatigue. The alkali reserve was constantly decreased during labor and slightly increased four hours after it, run ng inversely parallel to the bilirubinemia; the relat on between the two values indicates that the increase in bilirubinemia must be connected with fatigue. This concept is supported by 2 cases of uterine inertia in which the bilirubinemia was lower than in other cases, while the alkali reserve was higher. The parallel behavior during labor of muscular fatigue, alkali reserve, and bilirubinemia was quite evident in general. However, while the behavior of the alkali reserve was always proportionate to the intensity of the muscular fatigue, the behavior of the bilirubinemia was not, and in some cases of infrequent contractions it was also increased. This seems to be due to the fact that, in the increased afflux of bilirubin to the blood through contraction of the spleen following muscular fatigue, most of the pigment cannot be eliminated because the liver, already overworked, is incapable of handling the additional load; besides, the muscular fatigue, abstracting a considerable amount of glycogen from the liver, facilitates its decompensation.

Consequently, while the hyperbilirubinemia of pregnancy depends nearly exclusively on hemolysis due to hyperactivity of the reticulohistiocytary system, that of labor depends on numerous factors, such as hemolysis, increase in the abdominal pressure, paretic or spastic processes of the biliary tract, and other elements difficult to evaluate, and especially on the action of the uterine contractions.

RICHARD KEMEL, M.D.

Hunter, J. W. A.: Conservation of the Cervix Uteri in Operations for Prolapse: A New Operative Procedure. *Brit. M. J.*, 1939, 2: 991.

The author notes that in gynecology there is a necessity for subdividing patients undergoing surgical treatment into two groups—women of child-bearing age and those no longer capable of reproduction. He reviews the literature of cervical amputation and describes various complications and harmful sequelæ of the operation. A series of recent cases of repeated abortions following amputation of the cervix is reported. A series of recent cases of dystocia following amputation of the cervix is recorded also.

Fig. 1. A complete cuff of vaginal wall has been removed from the cervix.

Methods for curing a lacerated or diseased cervix as well as prolapse are suggested. For the repair of lacerations of the cervix a more extended use of Emmet's original operation of trachelorrhaphy should be considered. By excising two or more deep lacerations and carefully suturing the edges of the tears, an extremely distorted cervix may be restored to an almost normal contour. In cases of cervicitis with wide erosion and numerous nabothian follicles, the use of cauterization in preference to amputation might be advocated. In this connection, the results achieved by the author in treating cervicitis by diathermy cauterization and electrocoagulation have been extremely satisfactory. In cases in which there is hypertrophy and in which trachelorrhaphy or cauterization is unsuitable, amputation should be as shallow as possible, and high circular amputations should be avoided at all costs.

To meet the more difficult problem of prolapse in women of child-bearing age, the operation devised by Fothergill is supreme in its surgical cure of prolapse and is unequalled in its perfect results for women past the menopause. For women liable to further pregnancies, the amputation of the cervix, which is an integral part of the Fothergill operation, may be disadvantageous for reasons already shown.

In order to preserve the essentials of the Fothergill method and yet conserve the cervix, the author describes the technique of a new operative procedure. Its difference from that of Fothergill's lies in these steps: a circular incision through the vaginal mucosa is made about ½ in. above the external os, and another from 1 to 1½ in. above this. A complete circle of superficial vaginal epithelium is stripped off. A V-shaped excision of vaginal epithelium, as done in the ordinary Fothergill colporrhaphy, is made, starting from just below the external urinary meatus and extending downward and outward to join at the lateral aspect of the upper circular incision. The cervix is then stitched to the vaginal epithelium, the operator starting posteriorly and working around to the front on each side. Thus, the Fothergill principle of sliding the uterus up is maintained.

In 19 such operations performed by the author, the results have been uniformly satisfactory. There has been complete relief from symptoms, without any evidence of recurrence.

HERBERT F. THURSTON, M.D.

EXTERNAL GENITALIA

Picot, G.: The Treatment of High Vesicovaginal Fistulas by the Vaginoperineal Route (Le traitement des fistulas vésico-vaginales haut situées par la voie vagino-périnéale). *J. de chir.*, 1939, 54: 474.

Picot states that low vesicovaginal fistulas are usually of obstetrical origin and are diminishing in frequency because of better obstetrical methods, especially in cases of dystocia. High vesicovaginal fistulas usually result from total hysterectomy by the abdominal route when the operation is difficult, and especially after the radical Wertheim operation.

Low vesicovaginal fistulas can be successfully operated on by the vaginal route. For high vesicovaginal fistulas, urologists prefer the transvesical route, but other surgeons prefer the transperitoneal vesical route. The latter has the advantage of giving a good exposure, but there is a certain danger in the opening of the peritoneal cavity in the presence of a fistulous, and therefore an infected urinary bladder.

In 2 cases the author has successfully operated on a high vesicovaginal fistula by the perineal route; in one of these cases the fistula developed after a total hysterectomy, and in the other after a partial cystectomy for an endometrioma of the bladder, which was found to be extending from the cervix uteri.

Very little preparation of the patient for this operation is necessary; a de Pezzer catheter is left *in situ* for a few days before operation and the bladder irrigated twice a day. Either inhalation or spinal anesthesia may be employed. A curved prerectal incision is made extending somewhat further on the sides than for perineal hysterectomy; the vesicovaginal space is opened and the levator muscles are sectioned. The posterior wall of the vagina is sectioned in the median line, and a long catgut suture placed in each of the lips of the incision. With

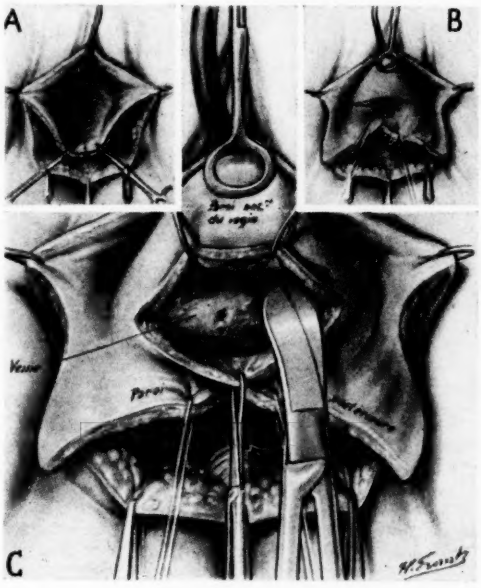

Fig. 1. A. Line of incision on the posterior wall of the vagina. B. Two curved incisions around the fistula and its surrounding cicatricial tissue. C. The bladder exteriorized with the anterior wall of the vagina. Note the exposure of the vagina. The bladder is separated from the vagina by blunt scissors.

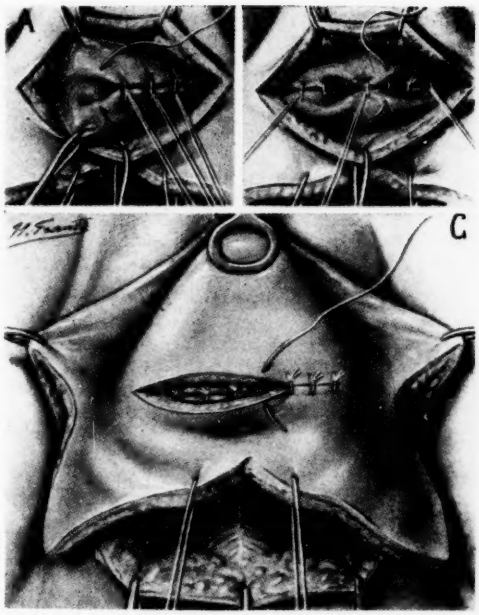

Fig. 2. Suture of the bladder in two planes and suture of the vagina.

these sutures and forceps on the anterior wall of the vagina, the vagina is brought down and forward and the anterior wall of the bladder exposed. The cicatricial tissue surrounding the opening of the fistula in the vagina is excised and the fistulous opening in the bladder exposed until it can be closed by enfolding with sutures in two planes. If the vesical fistula is so much to one side that there may be danger of involvement of the ureter, it is necessary to expose a larger area of the bladder wall and bring the ureter into view; if it is involved in the fistulous opening, the sutures should be placed in such a way as to invaginate the ureter in the bladder without injuring it. The opening in the anterior vaginal wall is sutured with catgut; the incision in the posterior vaginal wall is carefully sutured to give exact approximation of the edges; and the levator muscles are repaired. The vesical catheter removed at the time of operation is replaced and kept *in situ* for ten days, but is changed at the end of five days; the bladder is irrigated each morning. In the 2 cases in which this operation was used, satisfactory healing was obtained; the opening in the anterior vaginal wall closed completely and disappeared between the transverse folds of the vagina. The incision in the posterior wall of the vagina left only a slight linear scar, and there was also a slight scar in the perineum, the two ends of which were barely visible.

ALICE M. MEYERS.

MISCELLANEOUS

Villard, E., and Contamin, R.: The Treatment of Anorectal Tears by the "Curtain" Method (Le traitement des déchirures ano-rectales par le procédé "du rideau"). *Rev. franç. de gynéc. et d'obst.*, 1939, 34: 529.

Complete anorectal tears and rectovaginal fistulas are as difficult to repair satisfactorily after primary union has failed as they are distressing to the patient. The surgeon is handicapped in his efforts to restore structure and function in this region not only by the great retraction and thinning out of the tissues, but by the frequency with which secondary infection from the bowel contents occurs.

In 9 cases, seen some time after the original lesion, the authors made a "curtain" from the mobilized anterior wall of the rectum to protect the sutures beneath from constant direct contamination by fecal matter. The rectovaginal septum was split, the vaginal portion divided longitudinally, and the levators and sphincter fasciæ were re-approximated in the usual way. During the dissection the anterior rectal wall was mobilized for as much as 4 cm., in order to make a redundant flap. This was sutured to perineal skin edges well up over the sphincter repair, forming a half-circle "curtain" with its convexity anterior, to shield the underlying tissues from intestinal excretion. As healing took place, the apparently excessive mucous membrane retracted to form a normal mucocutaneous junction.

Of the 9 patients, 7 were completely cured years and months later, and the conditions of the 2 others were so ameliorated that the patients were continent even during episodes of diarrhea.

E. S. Burge, M.D.

OBSTETRICS

LABOR AND ITS COMPLICATIONS

Matthews, H. B., and Acken, H. S., Jr.: A Critical Survey of 1,066 Cesarean Sections. *Am. J. Obst. & Gynec.*, 1939, 38: 956.

The high classical technique of cesarean section stands convicted of a high maternal mortality, 3.9 per cent for all the classical operations as against 1.8 per cent for all the low-flap operations. It has been shown, however, in this analysis that the type of operation cannot be condemned alone. The classical technique bore the brunt of responsibility for such indications as toxemia and nephritis and cardiac and pulmonary diseases when the patient did not enter the operating room in good general physical condition, and when speed of operation was a most important consideration. There was one instance, however, in which the high classical operation did fail badly, namely, in the prevention of sepsis. The low-flap technique has in this series been responsible for no fatality from sepsis. The fatalities following the low-flap technique were attributable more to the technique of the operator than to the technique of the operation. The factor of experience of the obstetrician is one that cannot be overlooked. In listing the fatalities in chronological order and including the name of the operator, in preparing this study, it was an outstanding fact that the younger men of the service were much more frequently associated with maternal mortality. As time progressed and these men became more experienced their names did not nearly so frequently appear in this listing. This fact is noteworthy, for it occurred in spite of the organization of the service which demands and provides for careful supervision of the younger men by those of greater experience. This factor must be considered in evaluating any group of figures.

The maternal mortality of cesarean section is high, too high following some indications, particularly the toxemias of pregnancy. These weaknesses must either be eradicated or bolstered by a change in technique. Because of its greater incidence of sepsis and poorer results in repeat operations, the classical operation should be reserved for those cases in which the element of time is of prime importance. The low-flap operation is slightly more difficult in its performance, particularly in the obese patient, and the mortality associated with it can be more frequently attributed to the operator than to the operation. If cesarean section is to take its proper place as a means of escaping obstetrical difficulties, the following postulates must be rigidly observed:

1. There must be a correct indication for operation.
2. The proper type of operation must be performed at the proper time.
3. The operation must be performed by an obstetrician with surgical experience.

EDWARD L. CORNELL, M.D.

MISCELLANEOUS

Brews, A.: Hydatidiform Mole and Chorio-Epithelioma. *J. Obst. & Gynaec. Brit. Emp.*, 1939, 46: 813.

This paper is based on the author's personal experience with hydatidiform mole and chorio-epithelioma, supplemented by data derived from an extensive review of the world literature, and from an analysis of case records from the London Hospital, comprising 100 consecutive cases of hydatidiform mole treated during a period of thirty-three years, from 1905 to 1937; and 26 consecutive cases of chorio-epithelioma treated during a period of fifty-three years, from 1885 to 1937. Thus the average incidence in this large teaching hospital is 3 cases of hydatidiform mole a year, and 1 case of chorio-epithelioma in two years.

Included in the series are only cases of hydatidiform mole, or vesicular degeneration of the chorion, that were diagnosed macroscopically. Cases with minor degrees of vesiculation of the chorionic villi have been omitted from the series.

In 97 cases no uterine content other than molar tissue was recognized. In 2 cases there was a twin pregnancy, a normal fetus and a placenta coexisting with a hydatidiform mole, and in 1 case there were multiple focal areas of vesicular degeneration in a placenta with a well-formed fetus attached.

Etiology. The view that the condition is a primary disease of the ovum is the one most consistent with the evidence at present available. Das calculates the average incidence as 1 in 835. It is probable that this figure is an underestimate of the actual incidence in all pregnancies.

In the present series the age incidence is wide and confined to the fertile period, but one-third of the patients were forty years or more. In 26 per cent the molar pregnancy was a first pregnancy. Only 1 patient had had a previous molar pregnancy, and a follow-up of more than half of these patients has not revealed any subsequent molar pregnancies.

Clinical history of hydatidiform mole. In nearly 75 per cent of the cases the presenting symptom was abnormal uterine hemorrhage following a period of amenorrhea up to twelve weeks in duration. In 8 patients the amenorrhea was prolonged, lasting in 2 cases as long as forty weeks.

Clinical examination of hydatidiform mole. The uterus is typically larger than it should be in relation to the calculated duration of pregnancy. In 12 per cent it was the correct size; and in 16 per cent it was abnormally small.

The presence of signs of pregnancy toxemia at an unusually early period of gestation may be of significance. Albumin was present in the urine in 37 per cent of the 56 cases which were examined. In a few patients the presence of edema and hyperpiesis was also recorded.

There is a frequent association of cystic enlargement of the ovary with hydatidiform mole, for which the increasing knowledge of the sex hormones has provided a satisfactory explanation. The author records a 16 per cent incidence of associated cystomas. The largest cyst measured 23 by 13 by 7 cm. and was composed of luteal cysts up to 6 cm. in diameter. The occurrence of excessive lutein formation in ovaries which are not enlarged is also a frequent finding.

Luteinization of the ovaries in excess of that associated with normal pregnancy occurs in one or both ovaries, with or without their cystic enlargement, in association with the vast majority of molar pregnancies. It represents an atypical pregnancy reaction in the human ovary. The stimulus in each case is chorionic gonadotropic hormone, but in hydatidiform mole this often is applied in high concentration for a period of many weeks. The type of ovarian response, excessive luteinization without enlargement, small cystic enlargement, or gross cystic enlargement, will depend on the duration of the existence of the mole, its physiological activity in hormone production, and on the susceptibility of the patient's ovaries to the gonadotropic-hormone stimulation.

The type of response appears to be related to the age of the patient. Only 1 of the 5 patients with a cystic ovary discovered clinically was more than thirty years of age. The 1 ovary of the 14 removed and examined histologically that did not contain any luteal tissue was from a patient aged forty-five years.

Typical hydatidiform vesicles had escaped externally in 20 patients at the time of admission, and thereby a certain diagnosis was made possible.

Hydatidiform mole; gonadotropic-hormone assays. In 5 of 6 cases a positive Aschheim-Zondek reaction was obtained in a dilution of 1/200; in 1 case in a dilution up to 1/800. In the remaining case a negative reaction was obtained in undiluted urine. According to Zondek, if 200,000 mouse units per liter of urine can be demonstrated repeatedly in the urine and a positive reaction can be demonstrated in the cerebrospinal fluid, preferably in dilution, then an unqualified diagnosis of hydatidiform mole or chorio-epithelioma can be made.

The inferences which can be made safely from high gonadotropic-hormone assays have been limited by repeated demonstrations of the existence of a period of high production in association with normal pregnancies. This period is usually of about three weeks' duration, with a maximal level or peak of production about the sixtieth day of gestation.

As a method of absolute diagnosis of the presence of morbidly active chorio-epithelioma, quantitative hormone assays have failed to realize initial expectations, but assays far below Zondek's present standard of absolute diagnosis remain of great value, and constitute one of the six sources of information on which a diagnosis may be made.

The literature contains a number of recorded cases of abnormally low or negative hormone assays in association with hydatidiform mole. They probably represent examples of delayed or missed abortion of separated moles.

Exploration of the uterus. This was the confirmatory method of diagnosis in all cases in which there had not been any escape of vesicles from the uterus, before admission or during in-patient observation and investigation.

Differential diagnosis. The commonest error in diagnosis was that of regarding the abdominal swelling as an ovarian or uterine neoplasm. There were 10 such errors in this series.

TREATMENT OF HYDATIDIFORM MOLE

Only 7 per cent of the patients in this series have been treated by the radical method of removal of the uterus. Twelve per cent of the operations were supervised only, and the remainder of the patients received surgical intervention *per vaginam.*

The mortality of 1 per cent compares favorably with the mortality of 1.4 per cent published by Albert Mathieu for a collection of 576 hydatidiform moles amassed from 179 articles published in the literature during the three years, 1935, 1936, and 1937, and with Sherman's 2.5 per cent in 78 cases.

Complications

1. *Puerperal pyrexia.* Sixty-five per cent of the patients had fever. Torsion is a well recognized complication of large luteal cystomas, and may necessitate surgical treatment. Suppuration is much less common.

2. *Secondary hemorrhage following the evacuation of hydatidiform mole.* Seven patients were primarily treated by hysterectomy. None of these developed postoperative hemorrhage as a complication. One patient died before the mole was expelled. Of the remaining 92 patients 17 (18.4 per cent) developed secondary uterine hemorrhage within a few weeks of the expulsion of the mole. In each of these the uterus was explored and fragments of tissue were sent for microscopic biopsy. The biopsy of 10 of the 17 cases of secondary hemorrhage, i.e., 58.8 per cent, suggested malignancy, and half of the patients, 29.4 per cent, were subsequently proved to have chorio-epithelioma developing in the uterus.

3. *Chorio-epithelioma.* This complication commonly develops within six months of the abortion of the mole but it may be delayed two years or more. It is difficult to assess the frequency of this complication.

Like malignant cells, normal chorionic epithelium lacks differentiation and has the power of invading other tissues. Unlike malignant cells, chorionic cells do not multiply indefinitely. It is evident that a physiological destruction of the deeply penetrating and embolic remnants must occur. The presence of malignant changes in this unique tissue can only be assumed if the degree of epithelial proliferation, infiltration, permeation, and embolic dissemination is in excess of the normal.

Only 9 cases of spontaneous perforation of the uterus by a hydatidiform mole have been recorded in the literature, 1 of them being case No. 70 in this series. Of these, 3 terminated fatally, and probably these should be classified as chorio-epitheliomas.

Embolic dissemination of normal chorionic epithelium is an accepted occurrence. It follows that emboli of epithelium or villi from benign or malignant moles may also occur, in addition to emboli from malignant chorionic epithelium without villous formation. Thus a metastasis may be benign, somewhat malignant, or extremely malignant. In 1 case spontaneous resolution of a vaginal metastasis occurred after hysterectomy for secondary chorio-epithelioma.

Control of after-care with hormone assays. In 10 of the last 11 cases in the author's series hormone assays have been employed. So far there have been no cases in which a positive Aschheim-Zondek persisted for very long after the treatment of the mole

CHORIO-EPITHELIOMA

This disease, unlike hydatidiform mole, has been recognized in only recent years. The author reports 26 cases, 24 in women and 2 in men. The growth was preceded by hydatidiform pregnancy in 8 cases, recent abortion in 7, recent full-term labor in 4, and teratoma testis in 2; the details were unknown in 5 cases. The body of the uterus was the site of the primary growth in the majority of the cases; in several there was no primary growth in the genital tract because of spontaneous resolution. The majority of the women were between twenty and thirty-nine years of age.

Six of the 8 patients developing chorio-epithelioma after hydatidiform mole are known to have survived in good health for more than three years. All 4 cases following labor proved fatal. One-third of the patients have survived more than five years.

A post-mortem examination, not always complete, was obtained in the 14 cases which are known to have ended fatally. Pulmonary metastases were present in 9, 64.3 per cent. Vaginal metastases were present in 7 (plus 1 case of survival), 50 per cent. Cerebral metastases were present in 4, 28.6 per cent. Hepatic, intestinal, renal, suprarenal, cardiac, splenic, ovarian, and osseous metastases were each present in 3 cases, 21.4 per cent.

The author suggests that this survey of hydatidiform mole and chorio-epithelioma supports Blair-Bell's view that the etiology of cancer is wrapped up in the biology of the individual; that is, it supports the cell autonomy theory as opposed to the parasitic theory.

Chorio-epithelioma is a unique growth in that it is neither a true malignant growth of the cells of one individual nor a true implantation from a different individual. It is spontaneously cured more often than any other known malignant neoplasm, and yet, when resistance to its spread is broken down it runs a more rapidly fatal course than any other neoplasm. DANIEL G. MORTON, M.D.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Baiocchi, P.: The Lipoid Picture of the Tumor of Grawitz and Its Significance for the Nosological Interpretation of Hypernephroma (Il quadro lipidico del tumore di Grawitz e suo significato nell' interpretazione nosologica degli ipernefromi). *Riv. di chir.*, 1939, 5: 347.

Baiocchi has made a histological and especially a biochemical study of 2 cases of Grawitz tumor: 1 of the tumors had been removed recently and was kept in a 10 per cent solution of formaldehyde, while the other had been preserved in Kaiserling's solution for about nine years. (The author previously demonstrated that neither of these solutions alters the chemical composition of the lipoids contained in the tissues). Specimens for study were taken from 4 zones, each of which presented corresponding characteristics in the 2 tumors; these zones consisted of renal tissue free from tumor, tumor with large hemorrhagic focus, tumor without yellow deposit and with necrosis, and completely yellow tumor. The method of Bloor, modified by Boyd, which is the most accurate and complete method for the determination of the different fractions of lipoid metabolism, was used for the first time on tissues which were already fixed; it was thoroughly satisfactory.

The characteristic macroscopic aspect of the tumor is due to the deposition of large quantities of lipoids which are represented by all their principal fractions in varying amounts. The values obtained showed that the phospholipids and total cholesterol predominate over the other lipoid fractions, especially in the zone corresponding to the intensely yellow parts of the tumors. The lipoid picture of the zones of renal tissue free from tumor gave values which were varyingly lower than those found in the different tumoral zones examined. In the zones with large hemorrhagic focus, the lipoid picture presented values which were lower than those determined for intact renal tissue and for tumoral tissue, but were slightly higher than those found normally in the blood.

The histological, histochemical, and especially biochemical analogies between the so-called tumors of Grawitz and the other morbid manifestations included under the heading of lipoidoses induce the author to advance the following hypothesis (with reservations as more complete and more extensive studies on the lipoid metabolism may reveal other information): the tumor of Grawitz, or hypernephroma, should not be considered exclusively as a neoplastic entity in the strict sense of the term, but rather as a characteristic new formation of the renal parenchyma, in part or in its entirety, with cells having a large protoplasm and being rich in lipoid deposits, in which the phospholipid and cholesterol fractions are abundant. This new formation is not isolated or independent from the rest of the organism, but is intimately connected with a general morbid condition of the organism itself (lipoidosis), already pre-existing and operating slowly, i.e., in the sense of a profound alteration of the lipoid metabolism, especially of the phospholipids and of cholesterol. In short, the mechanism of origination of the tumor of Grawitz would be the same as that observed in the spleen in Gaucher's disease or in other lipoidoses.

RICHARD KEMEL, M.D.

Birdsall, J. C.: Urinary-Tract Obstruction in Renal Calculus Formation. *J. Urol.*, 1939, 42: 917.

Geographic distribution, heredity, climate, vitamin-deficiency diets, metabolic diseases, renal injury, focal infection, colloidal imbalance, and hyperparathyroidism, primary and secondary, may be accessory causative factors of renal calculus formation in a few instances, but they are not entirely the responsible agents in most cases. While there are numerous stone areas and a definite deficiency in the diets of the inhabitants of these districts, in the United States where the presence of vitamin deficiencies need not receive much consideration, the problem of the management of calculi still exists. While diets deficient in Vitamins A and D have resulted in the development of stones in the urinary tract experimentally, the practical application of the principles of diet for the purpose of causing a reduction in size or disappearance of renal calculi and preventing the formation of new stones has been most disappointing. The frequency of the presence of hyperparathyroidism in renal calculus disease has been emphasized, but in the author's cases, subjected to careful study of the calcium and phosphorus content of the blood, the results have usually been decidedly negative. It has been shown experimentally that renal insufficiency may give rise to hyperparathyroidism, hyperplasia, and hyperfunction. These observations suggest that primary renal insufficiency produced experimentally has stimulated the parathyroids to develop bony lesions comparable to osteitis fibrosa cystica, and also that the calcium content of the residual renal tissues has increased proportionately to the parathyroid enlargement.

A series of 211 cases of upper urinary-tract lithiasis (150 renal and 61 ureteral calculi) were studied to determine the various obstructive processes associated with calculus formation. There were found 141 cases of nephroptosis, 34 of bands and adhesions, 8 of obstruction of the vessels, 17 of stricture of the ureter, 4 of different types of anomalies (duplication, horseshoe or polycystic kidneys, and crossed ectopy), which were the underlying cause of hydronephrosis, stasis of the urine, and

calculus formation. Three cases gave a history of trauma, immediate hematuria, and subsequent calculus formation. In 1 case cancer of the ovary was the obstructive lesion. In 3 cases no obstructive lesion was demonstrable, although all 3 cases showed hydronephrosis.

Pyelographic studies revealed hydronephrosis in 170, pyonephrosis in 23, and pyelonephritis in 9 cases. Infection also played an important part and was found in 168 cases (43 with ureteral and 125 with renal calculus), and the organisms in order of their frequency were the bacillus coli, staphylococci aureus and albus, bacillus proteus, and non-hemolytic streptococci, all of which, except bacillus coli, are urea-splitting bacteria.

In 2 of 3 cases of horseshoe kidney with renal calculi there were recurrences, and in both cases the caliectasis was so large that correction of the stasis of urine was impossible. In the third case, the isthmus was divided and each kidney suspended; stones did not recur over a three-year period. In 6 cases, stones reformed in dilated calyces in which the urinary stasis was incorrectable by nephropexy. In 3 cases of nephrectomy for caliectasis, there were no recurrences in periods of five, three, and two years, respectively. In certain cases with well developed caliectasis or partial hydronephrosis in which correction of the nephroptosis or the obstructing vessel or band cannot correct the urinary stasis in the dilated calyx, partial heminephrectomy may be necessary for the prevention of recurrence of calculi. Postoperative adhesions at the ureteropelvic outlet occurred in 3 cases at the second operation and were responsible for the causation of unrelieved stasis of urine and infection with rapid calculus formation.

The management of cases of urinary lithiasis includes the taking of the history, study of the blood chemistry, and urinalysis. Roentgenography of the kidneys and ureters is most essential. Retrograde pyelography is preferable. Adequate correction of obstruction with elimination of the associated stasis of urine and infection is most essential in the prevention of recurrence of stone.

LOUIS NEUWELT, M.D.

Hess, E.: Resection of Rib in Renal Operations. *J. Urol.*, 1939, 42: 943.

To facilitate adequate renal exposure and minimize injury to the adjacent structures, the author favors resection of the lowermost rib. While not new, the technique has not found particular favor in America, but in some European clinics it has become almost a routine procedure. The advantages of rib resection include simplicity of operative exposure of the whole kidney and adrenal with a relatively small incision; protection of the iliohypogastric, ilio-inguinal, and intercostal nerves and vessels, which prevents anesthesia in the lower abdominal quadrant; and less direct trauma to the abdominal muscles which are always severely injured in all other loin incisions (which prevents

12th rib freed from its attachments
Gerota's fascia
Resecting 12th rib from it's attachment to vertebra
Wm. P. Didusch 1939

Fig. 1. Rib has been dissected free and is being resected from its attachment to the vertebra.

postoperative hernias). Seldom is retraction necessary and when it is, it need not be very forceful.

The technique is described in detail and amply illustrated. The patient is placed on the operating table as for the usual lumbar approach. Overelevation is unnecessary. The twelfth rib is palpated from its tip posteriorly and the incision is made directly over the rib, running from the tip posteriorly for several inches. Where the twelfth rib is rudimentary, the author has repeatedly removed the eleventh rib. The muscles are divided down to the rib, which is freed in its anterior third from the muscles and fascia by sharp dissection. This affords insertion of a large rib resector which is then dragged sharply toward the base of the rib and section effected as close to the spinous attachment as possible.

In removal of the rib, no attempt is made to do a subperiosteal resection. The intercostal nerves and blood vessels are preserved. The posterior portion of the freed rib is grasped with a clamp and the tip of the structure dissected free. The skin incision is enlarged and the approach to the kidney effected by opening the transversalis fascia and pushing the peritoneum forward. Blunt separation of the transversalis fascia protects the diaphragm and pleural reflection from direct injury. In addition to this precaution, care should be taken in closing the wound to avoid puncture of the pleura with the needle. Opening of the pleural cavity has occurred on several

occasions in the author's experience but without interference with normal postoperative convalescence. ARTHUR H. MILBERT, M.D.

Milovidow, V. E.: The Fate of the Remaining Kidney in Nephrectomy (Das Schicksal der nach Nierenentfernung uebriggebliebenen Niere). *Urologija* (Moscow), 1939, 16: 15.

On the basis of experimental measurements of kidneys in nephrectomized dogs, the author arrives at the conclusion that no new development of tissue substance (glomeruli, tubules) takes place in the remaining kidney.

Method of experiment. The right kidney was removed in 14 dogs. The remaining kidney was then removed from the operated dogs six hours and eighteen hours later, then two, four, five, six, eight, ten, twelve, fourteen, and eighteen days later, and then one, one and one-half, and three months later, respectively. These kidneys were then examined and compared with the corresponding kidneys which had been removed at first. The purpose of the experiment was: (1) exact observation of the histological changes in the remaining kidney; (2) on the basis of the macrometric and micrometric measurements of the kidney and its component parts, to determine at the expense of which of its component parts the remaining kidney compensated for the work of the removed one.

Results. In the remaining kidneys there were almost always accumulations of cells of a lymphoid and histiocytic nature, round or oval cells with compact nuclei, almost completely without protoplasm, which were situated chiefly along the course of the uriniferous tubules. Similar cells were found also in the removed kidneys, and although these cells were increased in number in the removed kidneys, nevertheless, the infiltration was not of such severity that one could speak of it as an actual inflammatory process.

A further histological finding was hyperemia of the tissues of the remaining kidney, especially pronounced from eighteen hours to twelve days following the operation, and found particularly in the glomeruli. In the lumen of the capsule of Bowman, free-lying erythrocytes were seen in addition to the hyperemia of the glomerulus. In some cases in addition to free-lying erythrocytes a proliferation of the endothelium and leucocytes, apparently resulting from irritation of the glomerule by toxins and metabolic products, could be observed. Similar findings were also noted in one of the removed kidneys. This finding, bordering on the clinical picture of irritation from glomerulitis was present, however, only in exceptional cases. With the exception of 1 case of nephrosonephritis a pronounced fatty or albuminous degeneration was not found.

The negative iron reaction in all of the cases points to the absence of blood extravasation in the kidney parenchyma and shows that the observed hyperemia was not accompanied by hemorrhage, and that the infiltration of round and oval cells in the interstitial tissues was certainly of extravascular origin. The author attributes the development of the hyperemia to reflex vasomotor influences, after the tying-off of the blood vessels of the removed kidney on the one hand, and, on the other, to irritation of the kidney tissue resulting from an increased concentration of metabolic products and toxins in the blood. Parallel with the diminution of the toxic metabolic products the hyperemia also gradually becomes less pronounced.

In order to attain a normal daily urine output the circulation in the remaining kidney must undoubtedly be increased in comparison to the normal. In keeping with this, the lumen of the renal artery was found to be increased: after a period of six hours the arteries of the excised and the remaining kidneys were of equal diameter; after eighteen hours the diameter of the latter had increased 0.4 mm. and then continued to increase in size in proportion to the weight of the kidney.

The weight of the remaining kidney varied in the following manner: After ten days it had increased 1 per cent, after twelve days it had increased by 10 per cent, after fourteen days by 13 per cent, after eighteen days by 10 per cent, after thirty days by 10 per cent, after forty-five days by 5.3 per cent, and after ninety days by 11 per cent. In a similar manner the circumference of the kidney and the thickness of the cortical layer became either increased or decreased within the limits of 0 and 6 mm. The thickness of the medullary substance varied similarly in proportion to the weight and circumference of the kidney but to a lesser degree, within the limits of 0 and 3 mm.

The observations carried out on the glomeruli and the tubules led to even more worth-while findings. However, in order to avoid false conclusions in these observations several considerations must not be overlooked: the measurement of the glomeruli as spherical bodies should not be done in only one direction. It should be noted that the diameter of these is smaller in the fixed preparation than in the living. Furthermore not all of the glomeruli nor all of the loops of a working glomerulus simultaneously take part in the circulation of the blood. Microscopically, the active glomeruli distinctly differentiate themselves from the inactive in the normal kidney. The inactive glomeruli have a diameter of from 80–120 μ; they are colorless and differentiate themselves but little from the surrounding kidney tissue. The glomeruli with a completely active circulation, on the other hand, have a solid, opaque appearance and are at times surrounded by the transparent lumen of the widened capsule. Between these two there occur transitional forms—glomeruli with only partially opened capillary loops. In the remaining kidney the number of active glomeruli was increased: in some of the sections studied from 40 to 80 per cent were found, whereas in the removed kidney the percentage of active glomeruli amounted only to from 20 to 40 per cent. In the remaining kidneys the number of active tubules was noticeably

increased at the expense of the inactive (collapsed) tubules. No special difference in the size of the active glomeruli and tubules could be found.

Conclusions. The increased size of the kidney results primarily from the increased activation of the glomeruli and tubules, from the increased capillarization of the partially active glomerule and increased diuresis, and not from the hypertrophy of the active glomeruli and tubules and their cellular elements. Thus the variability of the size and weight of the kidney becomes understandable.

Under normal circumstances a portion of the kidney energy remains in reserve and is utilized only when special demands are made upon the kidney. The kidney remaining after a nephrectomy doubles its burden and therefore becomes larger both in circumference and weight from the first postoperative days on. A true hyperplasia does not occur either at the beginning or later on. Even though a hyperplasia of individual epithelial cells has been observed it is very insignificant and can be found only in sparse mitotic changes in a few of the tubules. In the interstitial tissue of the kidney in which the regenerative powers are increased a mild development of connective tissue is seen in the interstitium.

The author describes further the clinical findings in 14 cases of nephrectomy which ended fatally following operation and in which the remaining kidney was examined histologically and measured in the same manner as described, and he presents extensive tables with the experimental measurements indicated. (R. Armsen). Harry A. Salzmann, M.D.

Menna, L.: The Absorption Capacity of the Ureter: Experimental Research (Sulla capacità di assorbimento dell' uretere: ricerche sperimentali). *Policlin.*, Rome, 1939, 46: sez. chir. 526.

The possibility of absorption by the ureter being still under discussion because of the contradictory results obtained by various authors, Menna decided to make a series of 5 experiments on adult dogs with solutions of indigo carmine (1.50 per cent) and of strychnine (1 per cent). Each experiment included 4 dogs and the amount of the solutions used was invariably 1.50 c.cm. One group of animals served as controls, in which the injections were given subcutaneously and the effect of the strychnine and the time of appearance of the dye in the blood and in the opened ureter were observed; of the 4 other groups, 2 each were subjected to the same operation, 1 group receiving an intra-ureteral injection of strychnine and the other an injection of the dye. In the first 2 groups, the ureter was isolated in its entire length and was ligated close to the renal pelvis and to the bladder before the injection was made, but the ureteral veins were respected at the sites of ligation; in the second 2 groups the ureter was simply ligated at the same levels without damage to the ureteral veins. In the cases of injection of the dye, the contralateral ureter was opened and blood was taken from the femoral vein every ten minutes to observe the time of appearance of the dye.

In the controls, the strychnine convulsions began in five or six minutes and death occurred after from thirteen to fifteen minutes; the dye appeared in the blood in from twenty to thirty minutes and in the urine in from thirty to thirty-five minutes. In the groups in which the middle efferent lymphatic and venous vessels of the ureter were interrupted, the results were inconstant, while in the groups in which the lymphatic and venous vessels were respected absorption of the solutions by the ureter was regularly positive. In the cases in which strychnine was used, the convulsions began between six and seven minutes after the injection and death supervened in from eleven to fifteen minutes, except in 1 animal that had twice the weight of the other dogs and consequently received too small a dose of strychnine. In the cases in which the indigo carmine was used, the dye appeared in the blood after ten minutes and in the urine after seven or eight minutes, except in 1 animal in which the fistulized ureter was obstructed by a clot of blood formed during the operation. Consequently, when its nerves and lymphatic and blood vessels are intact, the ureter absorbs the 2 solutions used and does this more rapidly and more intensely than the subcutaneous tissue.

Richard Kemel, M.D.

Howard, T. L.: The Management of the Ureter in Tuberculous Lesions of the Kidney. *J. Urol.*, 1939, 42: 1003.

Management of the ureteral stump following nephrectomy for tuberculosis has been a subject for discussion for many years. The author, by virtue of twenty-nine years of clinical experience and special interest in the subject, has arrived at several definite conclusions pertaining to the disposition of the ureter at the time of nephrectomy, the advantages to be derived from such a procedure, and the prevention of complications immediately following the operation. He also emphasizes the need for more careful attention to bladder symptoms and their alleviation following surgery.

The rationale and background of disposition of the diseased and infected ureter are reviewed. To the author, good surgical judgment and technique warrant exteriorization rather than burial of the infected ureteral stump. He believes that postoperative wound disruption and infection in such cases is directly attributable to pus exuding from ureteral slough and discharge of infected ureteral contents into the kidney fossa.

A surgical technique which has proved most efficacious in large dilated and infected tuberculous ureters in which lower ureteral strictures interfere with free drainage is described. The usual lumbar incision for nephrectomy is made and the kidney and renal pelvis are properly exposed. The renal pedicle is disposed of first, and whenever possible without clamps. With the kidney still attached to the ureter, the latter is mobilized and brought out from the lower angle of the wound. It is sewn to the skin, care being taken not to enter the lumen. The wound

is covered with an alcohol sponge and the kidney cut from the ureter, leaving, if possible, at least ½ in. of ureter protruding to permit introduction of a catheter or glass connecting tip into the lumen.

Final disposition of the ureter depends upon the clinical findings. If irrigations of the ureter are desired it is best carried out with a catheter placed in the bladder *per urethram* to facilitate continuous flow from above, downward, and out. Should the patient's bladder not require further therapy, the ureter can be tied off at the skin, and should it slough later it will not discharge its contents deep into the kidney fossa with disastrous results.

If technical difficulties do not permit initial ligation and severance of the renal pedicle, the author urges severance of the ureter as close to the renal pelvis as feasible and with utmost care to prevent infection from the infected stump. Covering the ureteral stump with a finger cot will dispose of it for the balance of the operative procedure and it can then be brought out through the lower angle of the wound, or if necessary through a stab wound below the kidney incision.

Such disposition of the ureter makes it possible to expose the entire ureter to radium by placing the metal in a catheter and passing it down the stump. The author hopes to report on this phase in the future and advocates its application when complete ureterectomy cannot be done following nephrectomy for papillary carcinoma.

Since using the above described procedure of disposing of the ureter, all wounds have healed satisfactorily without a single breakdown. Some of the stumps drain for a long period, but they drain on the skin where a simple dressing can be applied and the patient does not absorb the contents.

ARTHUR H. MILBERT, M.D.

Niosi, G. S.: Researches on Oblique Reimplantation of the Ureter into the Bladder (Ricerche sperimentali sul reimpianto dell'uretere in vescica [uretero-cisto-neostomia] col metodo del tragitto obliquo). *Clin. chir.*, 1939, 15: 761.

Transplantation of the ureter is indicated in a variety of clinical conditions, such as accidental section of the ureter in gynecological operations; ureterovaginal and uretero-uterine fistula; anomalies of the ureteral orifice with incontinence; bladder tumors near the ureteral orifice; congenital or acquired stenosis of the lower part of the ureter; and impacted calculi. The author discusses the history of the procedure and the theories and experiments of the various authorities who have contributed in this field (Poggi, Novaro, Bazy, Penrose, Kelly, and Israel). He describes and classifies the various methods suggested: (1) direct anastomosis; (2) the formation of a ureteral valve with an attempt to create an orifice larger than normal; (3) an oblique submucosal transplantation which attempts to reproduce the natural condition; (4) invagination of the end of the ureter until it extends freely into the bladder; and (5) anastomosis over a catheter as a guide. Clinically the direct anastomosis has given the poorest results. The oblique insertion tends to reproduce the natural course of the ureter and a functioning bladder orifice which does not permit reflux of urine from the bladder.

After discussing the literature in detail the author ascribes the failures of the operation to 3 types of causes: (1) mechanical (cicatricial stenosis, rigidity of the terminal part of the ureter due to an excess of connective tissue); (2) dynamic (loss of tonicity with resulting urinary stasis and ureterorenal dilatation); and (3) functional (insufficiency with vesicorenal reflux). He discusses these in detail.

The author performed oblique ureteral transplantation into the bladder in 10 dogs. He studied the bladder through the cystoscope, tested the function with dye, recorded the function of the ureter by ureterograms, and studied the tissues after careful autopsy. There were 3 failures due to the development of pyonephrosis and hydronephrosis. The other operations were considered successful after five, eight, and even thirteen months. The cases showed no interference with the dynamic powers of the ureter, as proved by recorded ureterograms; nor was there any reflux from the bladder into the ureter.

The author concludes that the oblique intramuscular implantation into the bladder causes the smallest number of failures from stenosis of the orifice. With this method, a continent, valvular orifice is created which conserves the renal function. Immediately after the operation there is a moderate hypotonia and dilatation of the ureter, but this is soon restored to normal, without any real damage to the kidneys. However, at the extreme end of the implanted ureter a connective-tissue reaction of variable degree is noted after many months, which may justify a reserved prognosis as to the ultimate results of the operation. JACOB E. KLEIN, M.D.

BLADDER, URETHRA, AND PENIS

Orr, L. M., Carson, R. B., and Novak, W. F.: A Statistical Study of Present-Day Methods Used in the Treatment of Tumors of the Bladder. *J. Urol.*, 1939, 42: 778.

A study of clinical results in the treatment of malignant tumors of the bladder by 267 surgeons is here presented, in which a crude analysis of more than 26,000 cases of bladder carcinoma form a basis for the discussion.

This analysis was obtained through the medium of a questionnaire in an effort to ascertain the method of treatment giving the patient the greatest degree of comfort and the longest life. For the sake of convenience, the questionnaire has been divided into 2 sections, one concerning "Conservative Treatment," which includes all methods of treatment other than total cystectomy, and the other, "Radical Treatment," which includes only total cystectomy and ureteral transplantation.

Of the 267 surgeons reporting, 221 favored conservative methods of treatment and only 8 favored

radical treatment or total cystectomy. The conservative methods used have been set forth in detail. Of all methods used in the treatment of bladder tumors, segmental bladder resection was considered as giving the patient the most comfort and the longest life by 51 surgeons.

Three hundred and fifty-three cases of total cystectomy and ureteral transplantation were collected. An average mortality rate of 33.2 per cent attended the operation. Ninety-two patients died during the first year. Eighteen patients lived more than five years, although the majority of the operations had been performed during the past five years. The reasons given by 57 surgeons for not performing total cystectomy were that the operation was too radical and the mortality rate too high; 66 stated that the patients were too old, the disease was too far advanced, or that renal damage had already occurred; 9 cited difficulties in convincing their patients and the referring physician; 14 stated cystectomies should be done more often in suitable cases; 12 admitted having insufficient experience.

This study has definitely brought out again the necessity for early diagnosis in cases of cancer of the bladder. Education, not only of the laity, but of the general practitioner, should be continued along methods which will result in patients with symptoms of bladder tumor being seen earlier by the urologist. Metastases to regional lymph nodes and distant organs is probably more rapid than has heretofore been assumed. C. TRAVERS STEPITA, M.D.

Hinman, F., and Smith, D.: Total Cystectomy for Cancer. *Surgery*, 1939, 6: 851.

Total cystectomy for the treatment of cancer of the urinary bladder has a rational place in the treatment of this disease, particularly in those cases of sessile infiltrating types of growths. The tumors that fall in this group are not helped by partial resection, dissection, or radiation therapy.

Since Gluck and Zeller in 1881 reported the first successful cystectomies with ureteral transplantations in dogs, and Bardenheuer in 1887 and Pawlik in 1889 performed the operations on human beings, there have been many attempts made to cure cancer of the urinary bladder by this method. The indications for the procedure are first infiltrating cancer of the base of the bladder involving the vesical outlet, the ureteral orifices, or both. Quinby will perform the operation only if there are no evidences of metastasis, if the patient is physically fit, and has one normal kidney.

Many methods have been devised for the short-circuiting of the urine. Many authorities transplant the ureters to the skin either in the cystectomy wound or into the groin or to the lumbar skin. Other operators divert the urinary flow by nephrostomy. The urethra and vagina have also been used, but in the majority of these cases now the ureters are transplanted into the rectosigmoid flexure.

The results of cystectomy in 254 cases show 87 operative deaths, a mortality of 34.2 per cent. Uretero-intestinal transplantation was carried out in conjunction with cystectomy in 137 cases with 53 deaths, a mortality of 38 per cent. It is not fair to quote the mortality for the whole group and accept it as the true mortality at the present time because recent improvements in uretero-enterostomy have markedly reduced the operative risk. Thus in 75 cases reported since 1926, there were only 19 operative deaths, a mortality of 25.3 per cent. The mortality is high whether the ureters are transplanted to the skin or bowel, and the only hope for improvement seems to be in early radical surgery while the tumor is limited to the bladder and the ureters are still normal.

Since 1925, the author has performed uretero-enterostomy on 50 patients suffering from cancer of the urinary bladder. Twenty-four of these patients never came to the radical removal of their cancers, 5 died within ten months of their operation, and 1 committed suicide one year and three months later. In this group of patients classified as inoperable as far as their cancer was concerned, 7 might have been operable. Six of the 7 died from the effects of the division, 1 of shock, 4 of renal sepsis, and 1 of circulatory failure. One other patient died of renal infection ten months later. Of the remaining 17, 12 died after operation: 5 of renal sepsis, 3 of generalized peritonitis due to faulty surgical technique, 2 of bronchopneumonia, 1 of bilateral hydronephrosis, and 1 of lobar pneumonia. Of the remaining 5, 4 died of their cancer within ten months; 1 was a suicide. One patient died twenty-four hours after cystectomy following a nephrostomy done twenty-five days previously. Twenty-five of the 50 patients with bladder cancer underwent both uretero-enterostomy with total cystectomy. All of these patients were operated upon within the past five years. Ten (40 per cent) died following operation and only 6 are living and well up to three and one-half years after operation. Seven patients died shortly after operation, 1 of renal sepsis, 2 of generalized peritonitis, 2 of pelvis abscess and sepsis, 1 of pneumonia, and 1 of massive pulmonary atelectasis. Three patients died later of the cancer.

Of the 50 patients only 24 were considered operable and 3 of these died later of their disease. Improvements in operative technique now will give, in properly selected cases, a much better mortality and morbidity record.

The first operative stage consists usually of right uretero-enterostomy. Two or three weeks later, the left ureter is transplanted to the sigmoid flexure and radical removal of the bladder is carried out in the following manner:

After the ureter has been transplanted, dissection of the peritoneum from the fundus and posterior surface of the bladder is begun before the peritoneum of the wound proper is closed. After closure of the peritoneum, the serosa is freed extraperitoneally from the bladder, well down into the cul-de-sac. Next the bladder is freed anteriorly and the pubovesical ligaments are divided, but the pubic area is

not disturbed because bleeding from the plexus of Santorini is sometimes very difficult to control. By blunt dissection carried laterally, first one and then the other vesical pedicle is isolated, doubly clamped, and tied. This controls the major blood supply. If possible, the seminal vesicles and part of the prostate are then freed from the rectum and extraperitoneal tissues. The farther down the dissection is carried dorsally, the easier the perineal portion of the procedure becomes. The abdominal wound is closed in layers without drainage.

The patient is then placed in the usual position utilized in perineal prostatectomy. The prostate is exposed and an extracapsular dissection of this organ is carried out. The prostatic urethra is divided, the fascia overlying the seminal vesicles is opened, and this plane of cleavage meets the one developed from above. The prostate, seminal vesicles, and bladder are thereby removed perineally *en masse*. Two wick drains and a tube drain are placed well up into the extraperitoneal space and the wound is closed. This procedure ensures excellent dependent drainage of the extraperitoneal dead space. ELMER HESS, M.D.

GENITAL ORGANS

Ballenger, E. G.: Affections and Lesions of the Prostatic Urethra. *J. Urol.*, 1939, 42: 481.

Pathological processes of the prostatic urethra may be congenital or acquired, the disorders organic or functional, the symptoms urinary or sexual, and either sharply acute or mildly chronic. The correction of these deep urethral lesions provides the solution for many of the troublesome problems encountered in the daily routine of the average urologist.

The author directs his attention to this vital segment of man's anatomy because he believes that the average doctor—and many urologists—have rather hazy ideas as to types of lesions and affections likely to be found there, nor do they have clear ideas of adequate therapy. Such situations result in neglect.

The history of posterior urethral dysfunction often leads to diagnosis for the discerning urologist. It may not be readily apparent and often it is necessary to ask leading questions or "read between the lines." The prolonged bed-wetting or masturbation of youth, hyperemic states of the deep urethra in adulthood, sexual aberrations in middle life, and prostatism in the aged all point to posterior urethral pathology. The diagnosis, while suspected from the history, may be confirmed by urethroscopy with the McCarthy panendoscope.

Among lesions commonly seen in the posterior urethra are: papillomas, cysts, bullous edema, false passages, diverticula, utriculitis and allied abnormalities of the verumontanum, varicose veins, angiomas, bands, bars, valves, fibrous contractions, and distortion produced by hypertrophy of the prostate.

Treatment cannot be carried out satisfactorily unless the meatus and urethra will admit a No. 26F bulb. Meatotomy, if needed, should be done at once and urethral strictures, if present, should be dilated gradually with sounds or incised as indicated by their location and caliber. After a reasonable amount of preliminary treatment, which should include antiseptics such as sulfanilamide, cystoscopic study of the deep urethra may be made. The abnormalities observed are treated with agencies which seem indicated. Such measures include dilatation, prostatic massage, and the application of phenol or nitrate of silver, or of the cutting or fulgurating current.

The author emphasizes careful consideration of the posterior urethra in the search for many of man's ill-defined and disturbing complaints, especially those which concern his urinary and sexual functions.

ARTHUR H. MILBERT, M.D.

Abeshouse, B.S.: Results in the Treatment of Prostatic Obstruction. *J. Urol.*, 1939, 42: 1101.

This is a study of the results of the three recognized surgical procedures for the relief of prostatic obstruction, namely, resection, suprapubic prostatectomy, and perineal prostatectomy.

The study is based on 434 cases of prostatic obstruction admitted to the urological service of Sinai Hospital in the seven-year period from January 1, 1932, to January 1, 1939.

The patients were classified as good, fair, and poor risks and the co-existing lesion in the urinary tract often influenced the choice of operative procedure. A large number of the resection cases presented severe damage to the cardiovascular system, while many patients in all the groups had serious lesions in other locations.

All prostatic patients were carefully prepared preoperatively. Suprapubic cystostomy was done only in those who had bad strictures or did not tolerate a retention catheter. Bilateral partial vasectomy was done routinely.

The patients were classified according to the type of obstruction, as median bar, hyperplasia, and carcinoma.

The anesthesias used included spinal, caudal, nitrous-oxide, and intravenous evipal. The ultimate results obtained were due to careful pre-operative care, perfect operative technique, and meticulous postoperative attention. The conservative attitude was taken in all cases. The indications, contraindications, advantages, and disadvantages of each method is given as follows:

TRANSURETHRAL RESECTION

This procedure is indicated for (1) median bar formation, (2) solitary median lobe hypertrophy, (3) solitary subcervical hypertrophy, (4) small or moderate sized hypertrophy of median and lateral lobes, (5) carcinoma of prostate—to relieve obstruction, (6) contractures of vesical neck or nodules or tags occurring after prostatectomy, (7) remove obstruction in cases of suprapubic fistula, and (8) patients in whom risk of prostatectomy is too great.

The contraindications to this procedure are: (1) massive bi-lobe or tri-lobe hypertrophy, (2) hy-

pertrophy complicated by stones or diverticula, (3) spongy edematous hypertrophy which bleeds readily on instrumentation, and (4) inability to pass resectoscope due to impassable stricture or distorted urethra.

The advantages are: (1) a lower mortality rate, (2) a shorter postoperative stay, (3) lower cost of hospitalization, and (4) the fact that the sex functions are not disturbed.

The disadvantages are: (1) a greater morbidity rate, (2) more frequent postoperative urinary infection and injuries to the bladder, and the fact that early or concealed carcinoma may be overlooked.

SUPRAPUBIC PROSTATECTOMY

The indications for this procedure are: (1) small, moderate, or large hypertrophy, (2) intravesical protrusion of the large median lobe, and (3) hypertrophy accompanied by bladder lesions, i.e., stones, tumors, and diverticulum, requiring surgery.

The contraindications are: (1) median bar, (2) fibrosis of the prostate, and (3) carcinoma of prostate.

The advantages are that the procedure (1) requires no unusual operative skill, (2) insures good functional result, (3) offers a greater chance for preserving sex functions than perineal prostatectomy, and (4) has a relatively low morbidity rate.

The disadvantages are: (1) a longer hospital stay, (2) greater cost of hospitalization, (3) imperfect visualization during operation, and (4) a relatively high mortality rate.

PERINEAL PROSTATECTOMY

The indications for this procedure are: (1) small, moderate, or large hypertrophy, (2) carcinoma of the prostate, and (3) fibrosis of the prostate.

The contraindications are hypertrophy with associated bladder lesions, i.e., stones, tumors, and diverticula.

The advantages are the facts that the procedure: (1) insures complete removal of all obstructing tissue, (2) provides perfect visualization and dependent drainage with minimum shock, (3) gives functional results as good as with suprapubic operation, (4) presents relatively low mortality and morbidity rates, (5) is curative in the early or concealed type of carcinoma and palliative in the late cases, (6) permits the application of radium at operation if necessary, and (7) requires a relatively short hospital stay.

The disadvantages are that it (1) requires complete mastery of the surgical technique to eliminate bad results, (2) gives functional results not as good as suprapubic resection except in the hands of the trained surgeon, and (3) creates a risk of incontinence, impotency, or of fecal fistula.

CONCLUSIONS

A study of 200 consecutive transurethral resections and 234 prostatectomies warrant the following conclusions:

Transurethral resection deserves a definite place in the operative treatment of prostatic obstruction. It is the operation of choice in cases of median bar, solitary median lobe, and solitary subcervical hypertrophies. Excellent results may also be obtained in cases with small or moderate-sized enlargement of median or lateral lobes. The operation affords palliative relief in cases of carcinoma with obstructive symptoms and provides an excellent method of removing obstruction caused by contractions, nodules, or tags following prostatectomy and in cases of persistent suprapubic fistula. We do not believe that the operation is suitable in cases with large bi-lobe or tri-lobe hypertrophies with marked intravesical or intra-urethral bulging.

Suprapubic prostatectomy is suitable for cases with marked enlargement of the prostate especially those accompanied by bladder conditions requiring operative treatment. The operation requires no unusual operative skill and insures a good and permanent functional result.

Perineal prostatectomy is an ideal operation for treatment of large hypertrophies and small fibrotic glands with or without prostatic calculi. It is the only method offering a cure of early or concealed carcinoma. It requires greater operative skill and, when properly done, insures an equally good functional result. The fear of incontinence, impotency, and fecal fistula are dispelled by complete mastery of the operative technique. ELMER HESS, M.D.

Agostinelli, E.: The Treatment of Prostatic Hypertrophy; Concerning a New Method of Anesthesia in Prostatectomy (Sulla terapia dell'ipertrofia prostatica. A proposito di un nuovo metodo di anestesia nella prostatectomia). *Policlin.*, Rome, 1939, 46: sez. chir. 505.

Agostinelli reviews the literature on one and two-stage prostatectomy, perineal prostatectomy, transurethral resection, and roentgen, radium, and hormone treatment of hypertrophy of the prostate. Before establishing any therapeutic line of conduct, he submits the dysuric patient to a protracted and complete study, the first step of which is the introduction of a permanent catheter or the performance of an epicystotomy. If the azotemia is included between 0.200 and 0.500 per 1,000, it is considered as a favorable sign for operability. Examination of the tongue should never be neglected as it is a true index to the urinary and general functional condition of the patient. Although the author had performed single-stage prostatectomy in 3 cases with excellent results, he abandoned it because of its inherent dangers and adopted the two-stage operation.

In his last 3 cases, he used local anesthesia, either to enlarge the cystotomy or to anesthetize the prostatic region. He anesthetizes the nerves of the prostate by introducing the needle, which is from 8 to 10 cm. long, perpendicularly and downward at a point located 3 cm. from the median line and from the upper border of the horizontal branch of the pubis; introduction of the entire length of the needle

places its point in the vesical pericervical and periprostatic region where 10 c.cm. of a 1:1,000 solution of percaine is injected. This is repeated on the other side; the abdominal wall is anesthetized and, before enucleation, 3 or 4 more injections are made in the prostatic and periprostatic region to insure complete anesthesia. The author calls this the abdominoprostatic method of anesthesia. He also proposes the prostatic perineotransvesical method, in which the patient is placed in the position of perineal prostatectomy and the index and middle fingers of the left hand are introduced into the rectum to force the prostate upward and forward in order to allow the injection to reach the adenomatous mass and its borders.

The author prefers digital enucleation and, whenever possible, suture of the edges of the incised mucosa to those of the prostatic capsule in order to avoid tamponing. If a tampon is used, it is necessary to make sure that the tampon, which is tied to the tip of the catheter and introduced into the urethra, can be pulled downward to allow it to exert sufficient pressure on the prostatic and vesical urethra. He describes the 3 cases in which he has employed local anesthesia. The largest prostatic adenoma which he has found was the size of a mandarine. The vesical wound was healed within a maximal period of thirty-one days. He questions the necessity of closing the hypogastric wound some days after the transvesical prostatectomy, as recommended by some authors. He is convinced of the advisability of early mobilization of the patient (on the fifth or sixth day) because this improves the general condition and prevents the occurrence of thrombophlebitis and of postoperative pulmonary congestion. RICHARD KEMEL, M.D.

Peršič, I.: Torsion of the Testis (Die Torsion des Hodens). *Zdravol. věstník.*, 1938, 10: 174.

This is a very detailed work containing a historical review of the literature on testicular torsion and an embryological representation of the normal 90-degree rotation which the testis undergoes to enter the scrotum. The degree of torsion of the testis is of significance with regard to the pathological anatomy. A rotation of 180 degrees maintained for several days is not so harmful to the parenchyma of the testis as one of 360 degrees lasting only six hours. All anomalies play a great rôle in the etiology of the condition. Ectopic testis, absence of the ligaments, anomalies of the blood vessels, and congenital hernias are frequently found associated with the condition. The most favorable factors for the initiation of torsion are vascular hyperemia, cremaster reflex, and trauma, as well as movement of the body and the limbs. The vast majority of the cases are observed during puberty because during this period the gland is undergoing a physiological vascular congestion as it changes its position. However, the condition may occur at any age of childhood; even in nurslings it is not so rare as one might suppose. Symptomatically acute torsion occurs in the region of the navel and radiates to the hypogastrium. Testicular pain, appearing suddenly and radiating to the lumbar region, occurs also. The pain may disappear but recurrences are frequent. When there is considerable accompanying scrotal edema, the clinical picture frequently suggests epididymitis or orchitis. Any pressure or blow may be followed by a slight swelling of the scrotum. General symptoms, such as diarrhea, vomiting, and general irritability, may come on simultaneously. Appearance of the tumor itself is a late occurrence which should make the true diagnosis evident. The author lays particular stress on a subacute form of testicular torsion, the symptoms of which are so mild and indistinct that it is rare for a correct diagnosis to be made. This concealed form manifests itself by recurrent pain in the abdomen, with or without vomiting. The pain may radiate to the hypogastrium, the navel, or the lumbar region. This form, the existence of which was established by the author's observations, has not been described heretofore. Difficulties in differential diagnosis have brought the author to the conclusion that every child who on examination shows the picture of an acute primary orchitis should be operated upon immediately. One must take the risk of operation, even though a non-surgical condition may be present.

Detorsion by operation is the only proper method of treatment. Preservation of the testis is the most important consideration. One should be very conservative in regard to semi-castration. Cases of 180-degree torsion are described, in which after relatively long periods, up to a month, the testis was preserved by simple detorsion. Even in cases of 360-degree torsion preservation is possible if operation is carried out within twelve hours of its onset. The spiral rotation of the spermatic cord of 1, 1½, or 2 complete turns is of great importance in the success of detorsion and preservation of the testis. If the testis is ectopic and has also undergone torsion both conditions must be corrected. Finally included for appraisal are the 15 cases which the author himself observed in the Paris Children's Clinic. In only 1 case was it necessary to sacrifice the testis. The left testis is always rotated clockwise, the right testis, counter-clockwise; thus torsion on either side is always toward the midline. Four cases of the 15 observed occurred in nurslings. The diagnosis made by the attending physician was most often some other abdominal condition, for example, appendicitis or constipation. Only a severe attack brought the child to the operating table. Many of the children suffered for many years but no one discovered the true nature of the condition. Operative detorsion was followed by complete cessation of the attacks. Four operative cases were under personal care and observation of the author. In only 1 of these cases a normal testis was retained. In the remainder (3) atrophy resulted in spite of the fact that at operation the circulation appeared excellent following the irrigation with warm salt solution. One may therefore conclude that strangulation of

the blood supply due to torsion of forty-eight hours' duration will be followed by atrophy of the gland in spite of detorsion.

(Gregora). August Jonas, Jr., M.D.

MISCELLANEOUS

Hunner, G. L.: The Fallacy of Depending on X-Rays in the Diagnosis of Certain Important Urological Conditions. *J. Urol.*, 1939, 42: 720.

The author emphasizes the value of instrumental study in conjunction with pyelographic investigation of the ureter in arriving at the diagnosis of ureteral structure. The technique is as follows:

The bulb must be placed near the tip of the catheter. If high stricture is present, roentgenograms must be made frequently to ascertain whether this high stricture is being passed by the bulb. For treatment the graduate bougie, reaching full size 5 cm. back of the tip, is resorted to far more frequently than in cases of low stricture. In the cases harboring high, painful stricture it is almost imperative, before dilatation is attempted, that a small plain catheter first be passed to the kidney for a slow lavage to the pelvis and ureteral mucosa with an anodyne solution. For this the author has found about equally useful 10 c.cm. of nupercaine (1 to 500); diothane 1 per cent; or larocaine 0.75 per cent. After a wait of ten or fifteen minutes following the local anesthesia the dilatation is far more likely to succeed. The author has tried the intramuscular injection of some of the newer anti-spasmodic drugs (given one-half hour before treatment) in a few cases but not enough to warrant an expression of opinion about its value. In some patients the drugs have seemed most helpful, while in others no change in the reaction to treatment could be detected.

The author illustrates several cases with roentgenograms, and reports some very interesting results from ureteral dilatation. J. Sydney Ritter, M.D.

Lacal, F.: Postoperative Humoral Disturbances in Surgery of the Urinary Tract (Trastornos humorales del post-operatorio en cirurgía urinaria). *Rev. méd. d. Rosario*, 1939, 29: 1033.

The postoperative period in surgery of the urinary tract creates serious changes in the metabolism and more or less accentuated modifications of the blood chemistry which, though they may escape clinical notice, are always revealed by a physicochemical analysis of the blood. The author has systematically studied the most striking modifications of the blood chemistry in a single patient, beginning with the pre-operative period and following up the same investigations of the blood and urine until the normal condition was re-established. The findings included:

1. Modifications of the acido-alkaline balance.
2. Postoperative azotemia and chloropenia.
3. Postoperative hyperglycemia.

If the cells of the organism are to perform their vital function, the blood must maintain a permanent and uniform reaction. Acid products admitted into the circulatory system either exogenically (alimentation), or endogenically (following metabolism of albumen, fats, and carbohydrates), create disturbances which endanger the vitality of the cells, unless the intervention of a regulating mechanism impedes these modifications and restores the balance between the acids and alkalis.

In the normal state the reaction of the blood fluctuates within narrow limits, but in pronounced pathological conditions the balance breaks down in the final stages of the illness. In case of an excessive production of acids or alkalis, in which rapid neutralization or elimination is impossible, though the excretory organs may function normally, either an acid or alkaline condition, respectively, is the result.

The blood plasma contains substances which separate its molecules into anions, charged with negative electricity, and cations, charged with positive electricity. In the normal organism the acid and alkaline values are always represented in a definite proportion, which is manifested by the actual reaction (pH) of the blood and tissues and varies only slightly. The values remain practically constant, not only in normal cases, but also in the great majority with acidosis and alkalosis. The fluctuations being negligible in the normal state, never surpassing 7.30 and 7.50, the pH of the blood is a *physiological constant.* The relation between the concentration of the H ions and the OH ions is slightly in favor of the latter, but is maintained constantly in a manner to create a true acido-alkaline equilibrium which, physicochemically, is expressed by a pH without deviations. If, however, deviations do take place, life is impossible, and the organism succumbs to acidosis or alkalosis, as the case may be.

The total CO_2 of the plasma is present in two forms: one results from the combination of CO_2 with H_2O, giving CO_3H_2, and the other combines with the alkali of the plasma in the form of bicarbonate (CO_3H). A small proportion of CO_2 is lost through the lungs, but the remainder plays an important rôle in the regulation of the acido-alkaline equilibrium. As CO_3H is extremely labile, its concentration is subject to sudden and violent modifications, showing extremes in either rising or falling when another anion of the plasma suddenly diminishes or increases. The same condition arises when an alkali of the plasma is decreased or augmented, the anion CO_3H being reduced or increased in order to establish the equilibrium of the sum total of the cations in their modified concentration.

If acids entering the vascular system in the course of metabolism and causing deviations of the acido-alkaline equilibrium are not neutralized by the organism and eliminated promptly by the excretory organs, the blood reaction is modified in a way which is incompatible with the life of the cells. However, the active intervention of tempering or neutralizing organisms transforms the strong acids into very weak ones, and the latter interfere with the blood reaction only slightly. The complicated mechanism

of autoregulation, which maintains the blood equilibrium, has at its disposal just such neutralizing agents to fall back upon in case of emergency. The ordinary sources of these neutralizing agents are the lungs, kidney, and liver. The neutralizing system is a combination of substances capable of tempering, without distinction, the acid and alkaline influences upon the solution of which they are a part, without severely altering the pH of the latter. This system maintains the ionic equilibrium of a solution, and tempers the increased concentration of H or OH produced by an accumulation of strong acids or alkalis. If such an acid enters the blood as a result of metabolism of the tissues, or by mouth or injection, the system immediately comes into action, neutralizing the strong acid by substituting an equimolecular quantity of weak acid, and bringing about the union of the cation of the acid with an alkaline of the plasma and blood corpuscles.

Likewise, when the blood is invaded by a strong alkali, the acid elements of the system act upon the base and neutralize it completely. For example: $Na\ OH + H_2CO_3 = NaHCO_3 + H_2O$.

The second stage in the regulation of the proper balance, in case of acidosis, is a diminished tension of the alveolar CO_2 with a reduction of the plasmatic CO_2 (non-gaseous acidosis). Inversely, in case of extreme alkalosis, the tension of the alveolar CO_2 increases, and the total CO_2 of the plasma is likewise and persistently increased (non-gaseous alkalosis).

Although the foregoing mechanism is of great assistance in neutralizing abnormal acid or alkaline accumulations, it is necessary that the excretory organs promptly eliminate the excess of acids or bases if the pH of the blood is to re-establish its normal balance.

During respiration in atmospheres charged with CO_2, the concentration of CO_3H_2 of the blood increases and results in gaseous acidosis. The same condition occurs in cases of asphyxiation, through accumulation of CO_2 in the blood. When CO_2 spreads to the plasma (acidosis), it combines with H_2O, forms CO_3H_2, and causes acidity of the blood. At this moment the neutralizing factors intervene; the carbonic acid (CO_3H_2) acts upon the chlorides of the plasma, and gives off bicarbonate at the expense of HCl. This strong acid cannot exist in the blood without altering the vital function of the cells; a portion of it combines with the proteins of the plasma, but its major part is carried to the interior of the red blood corpuscles where it is tempered by the bases of the neutralizing system. This displacement of Cl from the plasma to the blood corpuscles in cases of acidosis is called "Hamburger's phenomenon." It is produced when the blood is invaded by CO_3H_2.

Assisting the respiratory center in the equalization of the proportions of phosphates, the kidney takes over the rôle of eliminating phosphate acids. The kidney eliminates solid and organic acids which reach it from the tissues in the form of neutral salts. If these were eliminated as such, the organism would lose a great amount of valuable bases. To avoid such injurious drainage, the kidney produces ammoniac at the expense of urea in the blood, and thus replaces the bases by transforming, for example, salts of sodium into salts of ammonium.

During surgical intervention several factors are capable of creating deviations in the acidobasic equilibrium:

1. Anesthesia which acts according to its toxicity and manner of administration.
2. Pre-operative and postoperative fasting.
3. Surgical trauma.
4. Infection of the wounds.
5. Fever.
6. Renal insufficiency.
7. Toxins which originate and are reabsorbed by the digestive tract.

All these factors produce disgluconization of the liver and favor the disintegration of the proteins in the tissues.

Among the symptoms of postoperative acidosis appearing on the third or fourth day are restlessness, anxiety, incoherent speech, amnesia, apathy, and coma. The respiratory rhythm is accelerated; the pulse rate is from 100 to 120 per minute, in serious cases from 120 to 160, and 180 or more in prolonged cases. The extremities are cold and cyanotic, and perspiration is general. The temperature is lowered and there is oliguria, extreme thirst, and occasional bilious vomiting.

Alkalosis after surgical intervention appears suddenly between the third and fourth day with vomiting which becomes continuous. Other symptoms are apathy or irritability, cyanosis, no perspiration, normal temperature, partial meteorism, tachycardia, and hypotension. With progressive alkalosis there are signs of tetany, apnea, and unconsciousness.

Predisposing causes of acidosis are fever, anemia, undernourishment, and renal and hepatic disorders. Pre-operative inducing causes are fasting, cathartics, and morphine. Conditions favoring acidosis during operation are anesthesia, hemorrhage, and shock. Postoperative factors include fasting, dehydration, vomiting, fever, pain, and pulmonary complications.

Predisposing causes of alkalosis are persistent vomiting and the ingestion of alkalis. Several forms of alkalosis are distinguished: respiratory, nervous, cardiac, digestive, peritoneal, and one caused by coma or shock.

Azotemia is one of the first and constant occurrences of the postoperative period. It is not linked with chloropenia. It is coexistent with acidosis, but the existence of one does not necessarily imply the appearance of the other. The author attributes the condition to an abnormal protein disintegration of the tissues. The introduction into the circulatory system, through surgical intervention, of albumen originating in the devitalized tissues produces a

toxic reaction upon the organism, resulting in azotemia. Toxic albumens, liberated in the circulation, have a destructive action upon the normal albumens of the tissues.

Surgical intervention will, according to some authors, produce transitory hyperglycemia, particularly after operations on the genital organs, appendix, and in all acute inflammatory processes. Operative shock, general anesthesia, and excitement of the sympathetic nervous system are predisposing factors. According to the author, the nervous stimulus is transmitted, in part, by way of the sympathetic nerve to the suprarenal glands, and induces an increased secretion of adrenalin, which, in turn, stimulates the deposits of glycogen of the liver. Insulin injections moderate the formation of glucose at the expense of glycogen, and produce polymerization of glucose in glycogen; they also regulate the consumption of glucose by the tissues.

As a preventive measure for acidosis the author recommends a subcutaneous injection of 1 liter of glucose serum and 10 units of insulin, repeated twice in twenty-four hours. In case of existing acidosis this preventive treatment is followed by an intravenous injection of fresh 25 to 30 per cent hypertonic glucose serum; the quantity to be given is from 100 to 250 c.cm. and should be repeated every six hours. Twenty-five gm. of glucose and 25 gm. of bicarbonate in 1,000 gm. of water may be given in an enema, drop by drop (Murphy), every three hours. Medication consists of 3 or 4 gm. of bicarbonate of soda administered per os every four hours. Cardiac tonics are helpful.

In manifestations of alkalosis from hypochloremia, a fresh 20 per cent hypertonic solution of sodium chloride is injected intravenously, from 20 to 30 c.cm. every three hours. To combat dehydration, a subcutaneous injection of about 2 liters of physiological serum is recommended. Hypertonic solutions have the advantage of a simpler technique compared with physiological serum.

Postoperative azotemia and hyperglycemia receive the same treatment as acidosis.

HILDA H. WULLEN.

FRACTURES OF THE VERTEBRÆ

A Five-Year Collective Review

FRANK E. STINCHFIELD, M.D., Chicago, Illinois

ONE having a crushed vertebræ in his neck, he is unconscious of his two arms, and his two legs, and he is speechless. An ailment not to be treated." Thus in 2500 B.C. began the history of fractures of the spine. The next evidence of the early recognition of this subject was given by Hippocrates who treated fractured vertebræ by recumbency and traction, and, at a much later date, by Paré who used a similar plan.

A method of reducing fractured vertebræ called "Succussion" enjoyed popularity for a period of years. This consisted of hanging the patient by his heels to a ladder and then shaking the ladder and hoping for a reduction. In 1800 Boyer advised against using reduction, saying that it was dangerous. Dupuytren and others agreed to the policy of "laissez faire," while Abernathy said, "They are cases so generally fatal that I am convinced an assembly of old surgeons would doubt that there was a possibility of recovery in any case." A strong controversy was established between Sir Astley Cooper and Sir Charles Bell as to the value of laminectomy and thus the medical profession was shaken from the doldrums of thought in regard to these lesions and greater interest was stimulated. In 1867 Ashurst reviewed the literature and found that in fractures of the vertebræ, there was a mortality of 77 per cent and a recovery of 18 per cent. In 1889 Walton described a method of reduction called "Retrolateral flexion maneuver with rotation," which is substantially the method that is used today in the treatment of fractures of the cervical spine (Cole, 17).

Until about twenty years ago nothing much was done for fractures of the cervical, thoracic, or lumbar vertebræ because of the accepted postulates of the time which were: first, the deformity of a fractured vertebra cannot be corrected; second, fractured vertebræ heal more slowly than any other bone; and third, permanent disability is inevitable (Kleinberg, 48). The World War gave great impetus to the present-day treatment of spine fractures, and, together with the outstanding work done by Davis, Dunlop, Rogers, Boehler, and Watson-Jones, has radically changed these former postulates (Edye, 30).

In this collective review, the literature of the past five years has been read with the purpose of presenting as briefly as possible the modern concepts on the various aspects of vertebral fractures as presented by the outstanding workers in this field. Inasmuch as there is a great unanimity of thought, it has been considered impractical to mention all authors who have concurring opinions, but an attempt has been made to attribute specific methods and ideas to the originators.

ANATOMY AND PRINCIPLES OF TREATMENT

The diagnosis and proper treatment of fractures of the vertebræ are dependent upon a complete understanding of the anatomy involved. This is true in any fracture, but it is probably more important in fractured vertebræ because of the danger and not infrequent complication of cord involvement.

Edye (30) points out that each vertebra has an anterior part, or body, and a posterior part, or vertebral arch. They enclose what is known as the vertebral foramen. The successive bodies form a pillar for support of the head and trunk and the vertebral foramina constitute the canal in which the spinal cord is protected and lodged. Between the vertebræ there are two intervertebral foramina for the transmission of the peripheral nerves. The spongy substance of the body is covered by a thin coating of compact bone. The vertebral arch and transverse processes are compact bone. Because the body is the weaker component of the vertebra it gives way under stress or violence. The intervertebral discs act as buffers. The vertebræ are so firmly bound together that injury is more likely to cause fracture than simple tearing of the ligaments.

Emerson (31) very clearly lists the ligaments of articulation of the vertebral bodies as the anterior longitudinal ligament, the posterior longitudinal ligament, and the intervertebral discs. The ligaments of articulation of the vertebral arches are the capsules of the articular processes, ligamentum nuchæ, supraspinal ligament, ligamentum flavum, interspinal ligaments, and the intertransverse ligaments. Emerson also states that one-fourth the length of the entire spine is composed of intervertebral discs.

The principles of treatment as set forth by Chatterton (15) are to reduce the deformity, prevent ankylosis, break up impaction, and cause the fractured ends to come end to end. He warns that if vertebral fractures are not reduced soon after the time of fracture, there is the danger of disturbance of the blood circulation with a resulting aseptic necrosis. Crutchfield (23) states that the primary objective of any method of reduction in cervical fractures is to relieve cord compression. This applies to any vertebral fracture.

Battalora (5) and Kleinberg (48) quote Davis's principles necessitating anatomical reduction as being dependent upon the strength of the anterior longitudinal ligament, the fulcrum of the intervertebral articulation, and the firm attachment of the intervertebral discs together with the density and resistance of the lateral masses. Watson-Jones (106) agrees with these authors and adds that only if the limit of tension on the anterior longitudinal ligament is reached and maintained is it impossible for a vertebral body again to collapse.

On account of the anatomy as stated, Rogers (82) recommends that the patient be ambulatory only when the fractures occur in the convex portion of the spine, because in this location the body weight is borne on the posterior elements, whereas, if the fracture is in the concave portion, the weight is borne on the body proper.

CAUSES OF FRACTURED VERTEBRÆ

Fractures and fracture-dislocations are caused by direct trauma, indirect trauma, or a combination of the two, the type of trauma determining the nature of the injury.

Lambrinudi (51) states that fractures of the vertebræ are determined by the conformation of the bone as in atlas fractures, the structure of the bone as in divers' fractures C_5 and C_6, or the situation of the bone as in D_5 and L_5. By far the greatest number of fractures of the spine are compression fractures of the body of the vertebræ, and most of these are caused by forcible flexion or hyperextension, such as falling from a height and landing on the buttocks, feet, or directly on the back (Griffiths, 36; Newell, 68; O'Donoghue, 69; and Platt, 76).

Binkley (8) explains that the predominance of fractures at the dorsolumbar junction is due to the meeting of the immoveable thoracic and the moveable lumbar portions of the spine or that of the forward thoracic curve and the backward lumbar curve.

The widespread use of automobiles and motor vehicles and the popular enthusiasm for vigorous outdoor sports have done much to increase the number of vertebral fractures. However, there are many other contributing etiological factors which can be mentioned. Conwell (19) reports that 8,000 of the 13,000 fractures of the spine in the United States in 1937 were caused by automobile accidents, while Morrison and Flamson (64) tabulate the causes of compression fractures as direct falls 69 per cent, automobile and train accidents 16 per cent, direct trauma 9 per cent, forceful sitting 5 per cent, and heavy flexion in lifting 1 per cent.

According to Johnson (46) the most common causes of fractures and dislocations of the cervical spine are striking the vertex of the head with the neck in acute flexion, a sudden severe twist, diving accidents, and hyperextension injuries causing posterior displacement. Voris (104) accounts for the frequency of dislocation in the cervical spine by the fact that in this region the low flat vertebral bodies and articular processes are nearly horizontal, which predisposes to dislocation more than the conditions in the thoracic and lumbar regions where the processes are more vertical. Emerson (31) believes that the anatomical differences occurring in the cervical region account for the much higher percentage of fracture-dislocations in this region as compared to that of the remainder of the spine.

There is a small percentage of fractures caused by infections and metastatic lesions. Fortunately, however, these causes are in the minority as this type of fracture involves many more complications and problems than other fractures.

Within the past few years a new etiological factor has been introduced, which is the incurring of fractures during convulsions produced by metrazol, a drug used in the shock therapy of psychoses. Bennett and Fitzpatrick (6) and Bennett and Hamsa (38) report that in 41 per cent of the cases so treated, x-rays showed that one or more fractures had been produced.

In fractures of the pedicles, laminæ, and articular facets, Mensor (60) and Bailey (3) believe that there is always a coincidental torsion injury plus abnormal ligamentary pull, with hyperflexion or extension, as the case may be. White (108) and others believe that fractures of the transverse processes are usually a result of indirect violence, the process being fractured by muscular contraction.

Thus it is seen that the causation of spine fractures is extremely varied, and that it is imperative to suspect the presence of fractured vertebræ whenever there is any history of trauma or any symptoms referable to the spine.

X-RAYS

No discussion of fractures would be complete without giving due credit to the x-rays which have furnished such invaluable aid to definite and correct diagnosis. Without exception, all authors advocate the use of x-rays when fractures are suspected.

Rogers (82), in stressing the value of x-rays lists some of the findings which can be obtained only by this method of diagnosis. They include the loss of concavity of the anterior surface of the vertebral body, a zone of increased density, intestinal gas patterns suggesting ileus, A-P and lateral wedging, fragmentation, sometimes a crushing of the posterior wall of the body, and sometimes anterior and lateral dislocation of one body upon the other.

In general the conventional anteroposterior and lateral roentgenograms including more of the spine than just the suspected area are sufficient, but special technique incorporating oblique views as mentioned by Mensor (60) is needed in the detection of fractured processes. Anderson (2) and others (73, 84) state that considerable difficulty may be encountered in diagnosing these fractures because of confusion with old ununited fractures of the transverse processes, asymmetry of axes of transverse processes, shadows of the psoas muscle, rudimentary ribs, and anomalous ossification centers. Fractures of the transverse processes, in contradistinction to fissures and anomalies, are found to be in the middle of the process; they are irregular, and the distal end is displaced downward and outward, whereas an anomaly or fissure is usually transverse, well demarcated, and often bilateral or multiple.

There is one instance, however, in which x-ray diagnosis is of no particular benefit, that is, in fracture-dislocations in which reduction has taken place by the so-called recoil which leaves no pathological evidence. This point is brought out by Brookes (13) and others (20, 76, 106).

CLASSIFICATION AND INCIDENCE OF FRACTURED VERTEBRÆ

It has been said that between 4 and 6 per cent of all skeletal fractures occur in the spinal column (Edye, 30, Rogers, 84). Rogers states that 1 of every 10 cases is accompanied by cord injury and in 85 per cent of the cases, the intervertebral disc is ruptured.

It is reported that 90 per cent of the fractures of the vertebræ are compression body fractures; 50 per cent are of the first lumbar vertebra, and 25 per cent include the eleventh and twelfth thoracic and second lumbar vertebræ, the first lumbar vertebra being crushed twice as often as the second and three times as often as any other vertebra (Chatterton, 15, Binkley, 8). The reason for the high incidence of crush fractures between the eleventh thoracic and the second lumbar vertebræ is that in this region the thoracic and lumbar curves meet and create the greatest strain.

It must be remembered that there are frequent anomalies of the spine which are often confusing in the diagnosis of fractures. According to Pettit (73) 25 per cent of all lumbar spines show anomalies. Mensor (60) reports a series of 141 cases in which the frequency of fractures of the accessory processes was two and one-half times greater than the frequency of anomalies.

Whether the surgeon classifies the fracture as to cause (Anderson, 2); as first, second, or third degree (Parmley, 72); as traumatic or pathological (Johnson, 46); or as a simple wedge or comminuted fracture (Watson-Jones, 106), it must be remembered that the consideration of treatment of each fracture should be from the standpoint of the production of the greatest improvement in the condition with the least amount of danger to the patient.

FIRST AID

Probably in no fracture of the entire skeletal system is properly administered first aid as important as it is in fractures of the vertebræ. The time honored dictum of "Splint them where they lie" carries its maximum meaning in these cases. The correct first aid of fractures of the spine often means the prevention of a hopeless cripple, and not infrequently the actual saving of a life.

Much has been done in recent years to educate the laity as to proper first aid treatment, and it is a very happy and adequate reward to note that many of the dreaded complications have already shown a marked decrease directly because of this intensive educational program. As Palmer (71) has so adequately expressed, "The primary principle is to save the patient's life first, and then treat the fracture."

When a fracture of the dorsal, lumbar, sacral, or coccygeal segments is suspected, the following measures are recommended: (1) roll the patient to a prone position and lift in a hyperextended position; (2) put the patient on a rigid stretcher with arms folded under his head and possibly a small pillow under his chest to increase hyperextension; (3) place a blanket about the patient to conserve body heat and thus combat shock; and (4) obtain x-rays with the patient in a hyperextended position (71, 76, 69, 84, 90, 97, 109).

In transporting patients with suspected cervical fractures it is necessary to have them in a supine position, with slight traction on the head and a slight hyperextension of the cervical spine as this lessens the possibility of cord involvement (54, 76).

SIGNS AND SYMPTOMS

Unfortunately the signs and symptoms of fractured vertebræ are not constant nor are they always present immediately. However, there are very definite signs which, when present, are very pathognomonic. It is imperative in all cases of a suspected fractured vertebra that it be determined whether or not there is cord involvement.

Fractures with cord involvement. Coleman and Meredith (18) and Lambrinudi (51) give the following signs of a complete section of the cord. Usually there is an immediate and complete paralysis, with an absence of the Babinski reflex. (An early positive Babinski reflex in the absence of other signs of cord function distal to the lesion is evidence that the lesion is not complete.) There is absence of deep reflexes, deep sensibility, and tactile sensibility, distal to the lesion. There is retention of the feces and urine, and very often there is a low blood pressure.

Crutchfield (22) agrees to these signs and adds that when the cord is damaged in the cervical region there is a complete flaccid paralysis below the level of the lesion and often accompanying priapism.

Voris (104) recommends the use of Bastian's law and the Babinski response to determine the extent of injury to the cord, and says that in the early stages one cannot distinguish an anatomical severance from a physiological block of the nerve pathways, and strongly recommends lumbar puncture with manometric studies for determination of a subarachnoid block.

Fracture and fracture dislocations without cord involvement. Johnson (46) lists the signs and symptoms distinguishing a unilateral from a bilateral dislocation of the cervical spine. In unilateral dislocations the patient's chin is rotated to the opposite side and his neck is inclined to the side of the lesion, whereas in bilateral dislocations the head is held forward, tilted backward, and the neck appears shortened.

The symptoms of fractured cervical vertebræ range from pain, stiff neck, muscle spasm, and forward tilting of the head in the mild cases, to local hemorrhage, soft-tissue edema, referred pain along the arms, difficulty in swallowing, and paralysis in the most severe cases (Roberts, 81, Little, 53).

Fractures of the body. By far the most common vertebral fracture is the fracture of the body, which presents numerous signs and symptoms including: (1) localized pain at the point of fracture directly over the bony prominence and not over the muscle body, (2) muscular rigidity of the spine, (3) reduced flexibility of spinal movement at the level of the injury, (4) abdominal tenderness and rigidity in the lower dorsal and lumbar fractures, (5) girdle pains, (6) prominence of the spine of the involved vertebra (a kyphos), (7) inability to stand normally erect, (8) referred pain along the nerve roots, and (9) a feeling of weakness of the back and extremities (3, 5, 19, 28, 48, 50, 53, 54, 58, 59, 64, 67, 84, 87, 88).

All authors agree that one of the most important signs is a positive x-ray recording which shows the damage to the vertebra.

Fractures of the transverse processes. Fractures of the transverse processes may be due to either direct or indirect violence. Fortunately from an anatomical and physiological standpoint these fractures are not as serious as the ones already mentioned, but from a medicolegal aspect, great importance is attached to them. The findings usually present are marked localized tenderness over the affected processes, no deformity, muscle spasm, restricted motion, especially flexion, painful flexion and extension of the hip against resistance on the affected side, and a positive x-ray finding (Anderson,2).

Wiebeck (107) believes that the most reliable sign is that the bending of the trunk toward the healthy side is more painful than bending toward the injured side.

FRACTURES OF THE CERVICAL SPINE WITHOUT CORD INVOLVEMENT

Although fractures of the cervical spine do not hold first place in frequency, they certainly command the greatest respect in treatment. Within the past five years nearly 200 articles have been written concerning these fractures. Such volume of literature indicates the seriousness and multiplicity of the problems involved. However, again there is a great unanimity of thought, the only variations of opinion among different authors being on minor points in technique rather than on the fundamental principles involved.

The treatment of fractured cervical vertebræ begins immediately at the time of the first examination and, as Brookes (13) has so aptly expressed, "Accurate and absolute immobilization is the cardinal principle of early care."

Even though Cole (17) reports that in fracture-dislocation of the cervical spine there is still about

30 per cent mortality, Hudson (43) believes that the fear of fatalities following injuries to the cervical spine is not warranted and the outlook is excellent provided there is no cord injury. He says that conservative treatment offers the best prospect of recovery with the maximum amount of motion.

According to Plaut and others (44, 76) a fracture of the atlas is usually a tension fracture caused by such accidents as falling on a staircase or a "thank you, ma'am" fracture while motoring. ("Thank you ma'am" fracture as described by Dr. James Case is a rectangular shaped depression of the anterior superior surface of the vertebral body caused by a sudden severe jar while person is motoring.) When there is no cord involvement the symptoms are a stiff neck and occipital neuralgia. It is agreed that unless the deformity is severe, manipulation and reduction are not indicated because of the danger of injury to the cord. These men also point out that a fracture of the axis usually occurs at the base of the odontoid process and is associated with a unilateral fracture of the atlas and that bony union in this location is rare. The suggested method of treatment is prompt immobilization for from eight to twelve weeks in a well fitting plaster cuirass, after which a light re-enforced leather collar is worn for two months.

Dunlop (28) recommends the following method of treatment in fractures of the cervical spine:

A thin narrow board is placed on the table to support the body and neck up to the head. The patient is placed on the table with his head extending over the edge of the shoulder supports, and local anesthesia is then injected at the site of fracture. A Glissan sling is applied to the head and, by means of a block and tackle in which has been included a spring balance, traction, manipulation, and reduction are effected. Felt padding for the shoulders, occiput, chin, and upper chest is then applied and incorporated in a plaster jacket extending over the iliac spines. The patient is allowed to be ambulatory if there is no paralysis. The plaster is worn for from three to six months during the healing period, after which the patient is fitted with a leather collar. Heat, massage, and exercises are then instituted.

Fractures of the cervical spine may be either independent or associated with dislocations which may be unilateral or bilateral. In the treatment of unilateral fractures, the Walton method of reduction is commonly used. Johnson (46), McKenzie (58), Voris (104), Platt (76), and White (108) advise use of the procedure, which consists of the administration of a general anesthetic, increasing the deformity by rotation of the chin further in the direction already assumed, and slowly flexing the head laterally and posteriorly so as to cause slight hyperextension toward the side of the dislocation.

The Taylor method of reduction, which is popularly used in the treatment of bilateral dislocations, includes general anesthesia, the application of a head halter from which a band is extended around the operator's pelvis, and the exertion of traction in the line of deformity, and at the same time the production of a very slight flexion. When it is felt that the articular facets are dislodged, slow hyperextension is produced. The patient is then placed in a plaster collar extending from the occiput to the iliac crests. This is worn for from three to four months, after which a Thomas or Doll collar is worn for from four to nine additional months.

Hatch (39) and others (93, 81, 50, 76) advocate the reduction of cervical fractures by traction, believing chiefly in the use of head halters with varying amounts of traction, ranging from 6 to 15 lb. for periods of from six hours to a few days, depending upon the rapidity of reduction. Hoen (42) prefers the use of a 3 to 6 gauge chromium wire inserted through burr holes into the skull as in Cone and Turner's method. Stallard (93) and Hatch (39) believe in keeping the patient in traction in bed for from four to eight weeks during which time physiotherapy is administered. The others advocate early ambulatory treatment in plaster.

Within the past few years Crutchfield (20, 21, 22, 23) and Gallie (32) have made very noteworthy contributions to the treatment of fractures of the cervical spine. They both advocate skeletal traction by means of tongs. Their methods will be briefly outlined.

Gallie warns against manipulation in the cervical region and recommends in its place steady traction to the skull. Because he believes that head halters are ineffective and uncomfortable, he uses ice tongs which are applied directly to the skull immediately over the ears and which penetrate the bone one-eighth of an inch. The tongs are locked in place and from 20 to 30 lbs. of traction are applied for a period of from fifteen to twenty minutes to accomplish reduction. After this time a plaster-of-Paris head jacket, or minerva, extending down to incorporate the pelvis is applied. The tongs are kept in place until the plaster is completed. Gallie calls attention to the fact that this procedure may fail in cases in which the upper articular facets are locked over the lower ones. Under these circumstances he advises

open operation with levering of the facets into position.

The advantages of skeletal traction as given by Crutchfield (20, 23) are that it is more efficient than skin traction, it is free from the dangers of manual reduction, the force can be controlled, the method is painless, there is no danger of skin necrosis or spasm of the neck muscles, and nursing care is facilitated.

He lists the following as the only contraindications to the use of skeletal traction: (1) an extremely thin skull; (2) diseases or pathological conditions of the skull; and (3) infected scalp tissue.

Crutchfield has developed very ingenious mechanical tongs which are inserted transversely to the vertex in the vertical plane passing through the articulations of the cervical spine. The scalp is injected with novocaine and stab wounds large enough to admit the tong points are made with a controlled depth drill. A hole 2 mm. in diameter and 3 mm. deep is made. The tongs are inserted and locked in place. Traction is then applied horizontally. In high dislocation, 10 lb. is usually used and in low, from 20 to 25 lb. Traction is left in force for periods varying from a few hours to a few days, depending upon the rapidity with which reduction occurs. As soon as reduction is accomplished the weight is decreased to 4 or 6 lb. to obviate the possibility of stretching the ligaments. After complete reduction has been maintained for a time, a plaster collar is applied.

The authors of these various articles are of the opinion that open reduction has little or no place in the treatment of fractures of the cervical spine and many condemn its use. However, it must be remembered that each case presents its own problems and no hard and fast rule can be followed.

FRACTURES AND FRACTURE DISLOCATIONS WITH CORD INVOLVEMENT

Fractures and fracture-dislocations with injury to the cord present the most serious problem and offer the least hopeful prognosis of all fractures of the spine, as there is no possibility of regeneration of a completely divided cord. It is far from encouraging to note that these injuries in the cervical region still carry a mortality rate of 80 per cent.

The causes of spinal-cord injury are given by Palmer (71) as laceration, hemorrhage, and edema. He adds that these must be relieved within six hours after the injury or permanent damage will occur.

Johnson (46) and Lambrinudi (51) point out that the characteristic sign of a total transverse lesion of the cord is the fact that the patient presents a complete immediate symmetrical paralysis, flaccid in type, with sensory loss below the level of the lesion and with sphincter disturbances. Love (54) states that the location of damage to the cord is the deciding factor as to its severity, the higher being the more dangerous, and adds that permanent loss in function is usually due to thrombosis of the veins rather than actual tissue destruction.

Stookey (96) and others believe that in all cases of post-traumatic injury, lumbar puncture and a Queckenstedt test should be performed to determine whether or not there is a spinal-cord block.

In the treatment of fracture-dislocations with cord injury, the keynote is conservatism, which is a marked contrast to the employment of laminectomy which previously enjoyed great popularity. Manipulation and reduction of fractures with cord involvement is believed by most authors to be by far the best treatment. This is also applicable to fracture-dislocations with complete paraplegia as it is of greater therapeutic value than laminectomy. Boehler (12), Crutchfield (20, 22, 23), Davis (25), Dickson (27), and others (54, 66, 71, 83, 96, 106) all adhere to this principle.

Platt (76) believes in fixation in a plaster jacket with the spine in neutral position and no reduction when there is cord involvement, while Rogers (83) advocates merely jacket fixation with no hyperextension in cases of cauda-equina involvement only.

Voris (104) and Munro (66) believe that manipulation is poorly tolerated in these injuries and is worse than laminectomy. They agree with Crutchfield in giving trial traction, head halter or skeletal, for a period varying from four to thirty-six hours and then if there is no improvement, in considering laminectomy. They also point out, however, that such temporizing is very unsatisfactory.

TREATMENT OF VERTEBRAL BODY FRACTURES

The modern treatment of vertebral fractures is based on Boehler's principles of correct reduction and fixation, which are: correction of the displacement, holding the correction in good position long enough to allow bony union, and exercise of the limbs and body to the fullest extent. As there are so many methods of reduction it is obviously impossible to list them all; only a brief outline of each of the most commonly used will be given.

Davis method. The patient is placed in a prone position on a table. The legs are padded and suspended by means of a rope attached to a block and tackle on the ceiling while the patient's chest is supported by the edge of the table. Sufficient hyperextension is reached when a 45° angle of

suspension is obtained, at which point there will be persistent lumbosacral backache. After suspension for about twenty minutes, reduction is usually accomplished, and a circular plaster jacket is applied.

Davis (25) advocates this method because he believes there is less strain per degree of reduction, the restoration of the height of the centrum is more certain, and there is no compression force on the posterior area. A large number of surgeons favor the Davis method (5, 28, 48, 50, 69, 76, 85, 105, 109).

Rogers method. The patient is placed in a supine position on a flexible iron frame which is covered with canvas and attached to the bed. No anesthetic is given. Hyperextension is produced by lowering both ends, and usually reduction is obtained in about twenty minutes. When reduction is complete as shown by x-rays, the patient is moved to a Goldthwaite frame and a circular plaster is applied.

This method is especially applicable in cases of shock, internal complications, multiple fractures, and fracture dislocations with paralysis (Davis, 25). Adherents of the Rogers method include Billington (7), Kleinberg (48), Sucha (98), Stallard (93), and Talbot (100).

Rogers (84) recommends the following "sling method of reduction" for fractures of the dorsal spine above the eleventh vertebra. The patient is placed in a supine position with the trunk supported on a table, the occiput on another, and the lower extremities on a third. A canvas sling is put under the chest just below the level of the fracture, and the sling slowly raised until the column is suspended at a point just distal to the fracture. The portion of the table under the trunk and buttocks is then removed, the weight of the body above the fracture being allowed to impart extension and traction. After reduction a plaster jacket is applied, which includes the neck, chin, and occiput.

Rogers (84) has also described a "hammock" method for reduction of these fractures which is similar in some respects to the Watson-Jones method.

Watson-Jones method. The patient is placed in a prone position on two tables, with the shoulders and chest resting on one which is one foot higher than the one upon which the pelvis or symphysis rests. The trunk is allowed to sag between the tables until the degree of hyperextension determined by the patient's own anatomy is reached, at which point a roentgenogram will almost invariably show a complete reduction. A circular plaster is then applied.

Watson-Jones (106) believes that the chief advantage of this method is that the trunk finds its own limit of hyperextension, while in other methods the surgeon determines the degree of extension and supports the trunk in that position.

If failures should occur when using this method, they are quite likely caused by the fact that the patient has not been fully hyperextended. Watson-Jones emphasizes that the lower table must not extend higher than the thighs or pelvis, otherwise the lumbar spine will be imperfectly extended, or if the fore table is too close to the chest, the thoracic spine will be incompletely extended and will allow re-displacement. He adds that the plaster jacket should not be removed in less than four months.

The Watson-Jones method of correction is commonly used by Henry (41), Packard (70), and others (44, 48, 59).

Boehler method. This method very much resembles Davis's except that a perispinal anesthetic is first introduced. The reduction is completed by suspending the shoulders in fractures above the eleventh thoracic and the legs in fractures below the eleventh thoracic for from fifteen to forty-five minutes, the time depending upon the completeness of reduction. After this time a circular plaster is applied. Boehler stresses the use of postreduction exercises beginning the day following reduction and continuing for about a year. Sucha (98), Schwerdtfeger (88), and Talbot (100) favor this plan of reduction.

Dunlop method. The patient is placed in a supine position on a table and given avertin and a gas anesthetic. One assistant balances each arm and another each leg while both exert slight traction in opposite directions. The operator stands above the patient and passes a sling beneath the point of fracture. The assistants apply traction and the operator lifts upward causing hyperextension and reducing the fracture. The patient is then moved to a Goldthwaite frame where a circular plaster is applied (Newell, 68).

Magnuson method. O'Donoghue (69) and Nauth (67) advocate the use of a Magnuson jack which is placed beneath the point of fracture when the patient is in a supine position. The jack is slowly elevated until the fracture is reduced. The patient is then moved to a Goldthwaite frame and a circular plaster applied. The advantages of this method are that a slow hyperextension tends to prevent a paralytic ileus and the degree of hyperextension can be controlled by the surgeon.

Other methods. Binkley (8) and Emerson (31) advocate the use of a reverse Gatch bed to produce very gradual hyperextension. Conwell (19)

uses a Herzmark frame; Jostes (47) and Koven and Koven (49) suggest reduction by the elevation of a kidney plate on an operating table, while McKenzie (58) advises the use of a Whitman frame.

Even though all the afore-mentioned types of treatment are based on the underlying principle of hyperextension, there are a few instances in which it is contraindicated, such as in cases with torn anterior vertebral ligaments, with fractures of the laminæ, and with fractures in which the bone encroaches on the cord (Morrison, 64).

FRACTURES OF THE ARTICULAR PROCESSES

Although fractures of the articular processes are not unusual, their detection is difficult because of the anomalies in and about these processes.

Bailey (3) remarks that mere flexion and extension of the spine never cause fractures of the articular processes unless accompanied by a torsion strain which gives ligamentary pull plus abnormal leverage. He adds that the most common fractured articular processes are the second and third lumbar.

When there is no displacement, the only treatment indicated is immobilization in a circular plaster jacket.

Roberts (81) believes that fractures of the laminæ, pedicles, or articular processes almost always accompany a complete dislocation, but feels that the treatment of the serious injury usually takes care of the lesser.

Rogers (83) and Watson-Jones (106) believe that if there is lateral displacement of the interarticular joints and a lateral shifting of the spine, the articular processes may be locked. If the spine is hyperextended in such cases, reduction fails and cord injury may result. Therefore, open operation is indicated and one or both of the lower articular processes must be excised to allow reduction. However, Boehler (9) believes that open reduction is rarely, if ever, indicated.

Wiebeck (107) and White (108) advocate treating fractured articular processes with extensive physiotherapy, including exercises, diathermy, and massage.

According to Wiebeck (107), fractures of the transverse processes reunite only partly, while Bailey (3) calls attention to the fact that the prognosis of healing in the articular facets is poor if the fracture is near the tip of the process but good if near the base. Limitation of motion is seldom found, but sometimes bony bridges are formed between several transverse processes and bring about a certain stiffness of the spine (Wiebeck, 107).

FRACTURES OF THE TRANSVERSE PROCESSES

In the treatment of these fractures Anderson (2) advocates bed rest and hot packs for two weeks followed by adhesive strapping. The major portion of the treatment is concentrated on the soft-part injuries rather than on the actual bone pathology. Rogers (84) believes in firm adhesive strapping renewed at five-day intervals and, after two or three weeks, strenuous back exercises; he advocates the wearing of a belt for one or two months. The total disability in these fractures is between sixty and ninety days.

Fractures of the transverse processes are of grave importance from a psychological aspect. Several authors suggest not telling the patient that he has a "broken back" because to the patient this means a long convalescence or invalidism.

FRACTURES OF THE SPINOUS PROCESSES

Fractures of the spinous processes may be due to direct or indirect violence or muscle action, and usually are accompanied by some other fracture in that vertebra. The most common location of these fractures is the cervical region.

Treatment of these injuries usually consists of bed rest, head traction, and hyperextension with physiotherapy until the acute symptoms subside, and then allowing the patient to be ambulatory in a plaster jacket as recommended by Billington (7), or to wear a Thomas molded leather collar for from four to six weeks as advocated by Dunlop (28).

FRACTURES OF THE LAMINÆ

Fractures of the laminæ occur most commonly in conjunction with other fractures of the vertebræ and are usually caused by direct violence.

Mensor (60) states that the principles of treatment of these fractures without displacement are the elimination of large arcs of motion in the affected area, prevention of torsion and rotation movements, and preservation of normal curves and tonicity of the spinal musculature.

The customary treatment of such fractures consists of moderate ambulatory immobilization.

Morrison (64) warns against hyperextension in fractured laminæ because of the danger of cord involvement. Irwin (44) and others state that open operation is indicated when it can be seen that the laminæ are pressing on the cord, and adds that the prognosis is good when the operation is performed early.

FRACTURES OF THE SACRUM

The treatment of fractures of the sacrum is essentially that of fractures of the pelvis, including

bed rest, heat, traction, the use of a suspensory sling, and adhesive strapping. When the patient is allowed to be ambulatory, a well fitted belt is applied (Henry, 41).

FRACTURES OF THE COCCYX

Conservatism is the rule as long as possible in the treatment of fractures of the coccyx (Henry, 41). Irwin (44) states that the two possible methods of treatment are the manipulation of the distal fragment into normal position, and the excision of the distal fragment. However, both are attended with a high degree of failure.

No method has as yet been found which gives uniformly good results, but hot sitz baths, strapping, correct sitting, and massage will serve as conservative measures and will often give relief.

IMMOBILIZATION AND AFTER-CARE

The placing of the patient in a circular plaster jacket after reduction is by far the most generally accepted method of immobilization. All writers stress the fundamental importance of having pressure at three points: namely, the symphysis, the manubrium sterni, and the point of fracture.

It is also generally agreed that the time of immobilization depends upon the fracture, the angulation of the arcs, and the rapidity with which new bone is formed. Chatterton (15), Conwell (19), Pollosson (79), and others (36, 39, 47, 64, 69, 82, 88, 102) agree that the patient should be kept in a hyperextension plaster for periods varying from eight to twelve weeks. Another point of agreement is the importance of muscular exercises as advocated by Boehler. A great many allow the patient up within the first week after reduction.

All of the authors recommend the use of some support such as a Taylor back brace for periods varying from three to nine months following the removal of the plaster. The discarding of the brace is dependent upon the x-ray evidence of solid bony consolidation. The average period of disability is from ten to twelve months, although advancing years, vertebral deformity, and hypertrophic arthritis as mentioned by Thomson (102) directly influence the amount of disability.

Exceptions to this commonly used plan are: first, keeping the patient hyperextended in a reverse Gatch bed for two months and then allowing full motion in a Taylor brace (Binkley, 8); and, second, keeping the patient in bed in a hyperextended plaster for from fourteen to sixteen weeks and then allowing complete freedom in a Taylor brace.

Magnus (55) criticizes the concept of "reposition" as he believes that the patient can reduce his own spine better without manipulation and plaster. He says there are only two indications for reposition—to repair paralysis of the cord impaired by compression, and to correct badly deformed vertebræ. He also criticizes indiscriminate use of hyperextension because it may cause increase of edema and hemorrhage, there is danger of fat embolism during reduction, and there is long-lasting disability during immobilization.

LAMINECTOMY

The present trend in treatment of fractures of the spine is definitely away from open operations. Some authors state very positively that laminectomy has no place in the treatment of these injuries as they believe that closed reduction and careful attention offer a much better prognosis.

However, there are still many instances in which laminectomy is indicated. Those mentioned by Dickson (27), Little (53), McKenzie (58), Stuck (97), and others (18, 71, 76) include: (1) severe, incomplete cervical lesions with no progress for forty-eight hours; (2) severe incomplete dorsal injuries with spinal block as determined by a Queckenstedt test; (3) complete lesions of the cauda equina with compression caused by fracture-dislocation; (4) direct pressure on the cord by an impinging bone as shown by x-rays; (5) cases of complete paralysis with some evidence of recovery within forty-eight hours; (6) localized pathology in cystic arachnoiditis; (7) cases in which closed reduction has been accomplished and improvement occurs for a period and then ceases; and (8) paralysis developing hours or days after the accident, indicating hemorrhage, or edema.

The contraindications to laminectomy are best stated by Stookey (96): (1) better reductions can be accomplished by non-operative treatment; (2) laminectomy removes much of the bone structure which is invaluable for stability of the vertebral column; and (3) opening into the dura mater will allow the cord to extrude and permit rupture of whatever intact spinal-cord substance may remain, and thus convert a partial injury into a complete anatomical one.

SPINAL FUSION

Since the advent of the modern method of reducing and treating vertebral fractures, the need for spinal fusion has been diminished very greatly. However, Palmer (71) and others (76, 41, 60) recommend doing a spinal fusion in young patients suffering from old fractures, in cases of Kuemmel's disease, in healed fractures with persistent pain, and in non-union or malunited fractures of the pedicles, laminæ, and articular facets.

Rogers (82) advises the fusing of at least four vertebræ whenever spinal fusion is indicated.

Jostes (47) reports that only 85 per cent of the patients obtain relief after spinal fusion has been performed. However, the reason that the other 15 per cent are not free from pain may be some other complicating factor.

COMPLICATIONS

Probably in no condition in medicine other than pneumonia is good nursing care as important as it is in fractures of the vertebræ with cord involvement. Crutchfield (22, 23) states that in fractures of the cervical spine with cord involvement, the patient should be placed on an air mattress supported by fracture boards, his heels never being allowed to touch the bed clothes. He recommends immediate suprapubic drainage.

LaFerte (50) and Munger (65) believe in trying to develop an automatic bladder which overflows regularly. They observe that the higher in the spine the fracture occurs, the more chance for automaticity, and the lower the fracture, the greater the chance for vesical-neck spasm and the less chance for automaticity. They also warn that if automaticity does not develop, suprapubic drainage should be instituted.

Love (54), McKenzie (58), O'Donoghue (69), and others (96, 104) agree that the best type of bladder drainage is obtained with the use of an inlying catheter, which is irrigated twice daily with 4 per cent boric-acid solution and is changed every four or five days. The point is made that distention of the bladder should never be allowed and the urine should always be kept acid. A common complication of fracture of the vertebræ is temporary paralytic ileus, probably due to retroperitoneal hemorrhage with sympathetic stimulation. A number of authors have suggested the use of constant Wangensteen suction and the hypodermic administration of eserin, the application of hot stupes to the abdomen, and the use of high enema tubes.

The following suggestions are given for the general treatment or prevention of various complications: (1) the use of an air mattress; (2) the regular administration of mineral oil by mouth to prevent hardening of the feces; (3) frequent turnings of the patient and alcohol rubs every two hours to prevent decubitus; (4) extreme care in keeping the sheets clean, dry, and free from any irritating substance; (5) restriction of fluids by mouth in the early stages; (6) continuous intravenous administration of glucose in saline solution; (7) a high vitamin diet; (8) administration of viosterol; (9) passive motion and exercise of the arms and legs; and (10) giving of acidophilus milk to diminish gastro-intestinal intoxication (22, 58, 54, 65, 69, 96, 104).

Voris (104) mentions the common complication of hyperthermia which should be combated with antipyretics, sponging and ice bags, and colon irrigation.

A very important aspect of treatment is mentioned by Love (54) and Stookey (96) who emphasize that it is essential to protect and develop the patient's morale and start rehabilitation as soon as possible.

Thus it is seen that the surgeon treating fractured vertebræ is confronted with a multiplicity of problems, all of which require meticulous care and careful study.

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SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Imperati, L.: Apophyseal Osteomyelitis (Le osteomieliti apofisarie). *Arch. ital. di chir.*, 1939, 56: 612.

As a result of their peculiarities of structure and circulation, the apophyses of the bones are even more rarely attacked by osteomyelitis than the short and flat bones. Imperati limits his discussion to non-specific acute and chronic infectious osteomyelitis and reports 6 cases.

His first case is one of the spine of the right scapula in a boy aged seven years. The swelling was especially marked over the supraspinous fossa which presented decided fluctuation. After incision and evacuation of the pus, digital and instrumental exploration revealed a small, irregular and denuded zone at the lateral third of the spine of the scapula in the vicinity of its cartilaginous junction with the acromion. The patient improved rapidly under ambulatory treatment. The elective localization of osteomyelitis of the scapula is that found in the present case and its suppurative evolution is toward the supraspinous rather than the infraspinous fossa, although it may be along the thoracic wall or even the arm. The symptoms do not suggest the exact osseous localization of the process and the roentgen picture usually does not furnish decisive information in the first stage of the disease, even when it is possible to avoid superimposition of images: however, a film taken forty days after the beginning of the process showed a zone of lacunar resorption of the apophysis.

Although primary and isolated osteomyelitis of the great trochanter is considered exceptional, the author has observed 3 cases during the past few years. The ages of his patients were nine, twelve, and twenty-eight years, respectively, and the disease was preceded by a slight trauma seven days previously in the last patient only; however, the value of the traumatic factor in osteomyelitis of the great trochanter should not be underestimated. The disease remained localized to the trochanter during its evolution and ended in partial necrosis with limiting condensing osteitis, probably because of the low virulence of the infection as shown by the relative mildness of its clinical course. Usually, the disorder is mistaken for an abscess of the buttock or thigh or for a suppurating bursitis, and exploration of the pocket after incision will reveal denudation of the bone. The sequestrum must be eliminated before healing can be obtained. Roentgen examination is of little help in the beginning of the disease, but is valuable later on when decalcification or limited necrosis is present. Differentiation from tuberculosis is difficult in the rare cases of chronic trochanteritis from the beginning.

Osteomyelitis of the olecranon is probably the rarest of all forms. The author's case was chronic from the start and occurred in a woman aged fifty-nine years. The absence of decalcification, the presence of a small sequestrum and of a marginal osteophyte, the operative findings, and the course of the disorder, ending in cure, excluded tuberculosis and favored the diagnosis of a non-specific osteomyelitis differing from the ordinary forms of the disease; the unusual age of the patient explained the extreme slowness of healing. Although the disorder was present for eight months before the correct diagnosis was made and adequate treatment was instituted, the lesion was still limited to the olecranon and the elbow joint was not involved.

The last case was one of subacute osteomyelitis of the upper humeral epiphysis localized to the supero-external contour of the humeral head at the limits of the great tuberosity, which was probably also involved although roentgen examination did not demonstrate it clearly. The process was extra-articular in spite of the roentgen findings, according to which the joint should have been involved. The intervention was entirely extra-articular and resulted in complete cure. The symptoms of this disorder are usually slight: there is subacromial swelling with the signs of a superficial abscess, but the articular function is always more or less compromised. In the advanced stage, roentgen examination alone can demonstrate the apophyseal lesion: the whole apophysis may be detached under the form of a sequestrum.

The differential diagnosis of apophyseal osteomyelitis is important because of the therapeutic indication which is always surgical, while in tuberculosis and in developmental osteodystrophy the treatment is conservative. RICHARD KEMEL, M.D.

Contini, V., and Francini, G.: Experimental Osteo-Arthritis with Mixed Infection (Osteo-artriti sperimentali da infezioni miste). *Prat. chir.*, 1939, 5: 191.

The author reviews the history of our knowledge of mixed infections beginning with the studies of Pasteur in 1863. In a mixed infection there are three possibilities: (1) the micro-organisms may have no influence on each other; (2) they may stimulate each other; (3) they may inhibit each other. The authors then present a review of the literature on the behavior of the staphylococcus, streptococcus, bacillus coli, bacillus pyocyaneus, and the tubercle bacillus in mixed infections. For example, Emmerich has reported that the pyocyaneus bacillus has an inhibiting effect on the staphylococcus and the streptococcus, but not on the tubercle bacillus. On the contrary, small numbers of tubercle bacilli render more intense the inflammation caused by the streptococcus. Also it is noted that in guinea pigs previously rendered tuberculous the bacilli have a

sterilizing effect on subsequent staphylococcus infection.

Acute infective arthritis is caused in the majority of instances by the common pyogenic bacteria (streptococci, staphylococci); pneumococci; and more rarely by the staphylococcus pyogenes aureus, streptococcus hemolyticus, or streptococcus viridans. More rarely the bacillus of Pfeiffer, bacillus pyocyaneus, diphtheria bacillus, bacillus enteritidis, and bacillus coli may cause purulent arthritis. According to the mode of production there are three types of arthritis: (1) traumatic arthritis in which the pathogenic micro-organisms enter the joint through a penetrating wound; (2) arthritis which is spread by contiguity from infection of the adjoining tissues; and (3) hematogenous infective arthritis secondary to a blood-stream infection. Acute infective arthritis begins as a synovitis. The cartilage, ligaments, and subchondral bone tissues are involved secondarily. However, in osteomyelitis the arthritis is derived secondarily from the focus of infection in the bone. Acute arthrosynovitis is usually exudative in type and may be classified according to the exudate as serous, serofibrinous, and purulent. In suppurative arthritis return to a normal joint is possible only when there has been no destruction of the ligaments, internal capsule, cartilage, or bone. Fiorentini, who isolated a staphylococcus aureus from the pus of a suppurative arthritis of the knee, injected adult guinea pigs and was thus able to produce pure articular lesions consistently.

The author's review of the literature indicates that there have been comparatively few experimental studies on mixed infection in arthritis. The authors therefore devoted themselves to a bacteriological and anatomopathological study of infective arthritis induced by mixed infections, in rabbits and guinea pigs. The knee joint was chosen for study. The bacteria used were the staphylococcus pyogenes aureus, bacillus pyocyaneus, bacillus coli, streptococcus, and tubercle bacillus (both human and bovine types). The technical procedures are described in detail, including the bacteriological methods, autopsy technique, and histological study of the infected joints.

In all, 12 groups of experiments with varying combinations of the afore-described micro-organisms are described in detail. There are numerous illustrations of photomicrographs and bacteriological colonies. The effects of these infections may be classed as general and local. The general reactions were fever and marked loss of weight. The streptococcus and staphylococcus were most virulent in this respect. Besides the joint lesions, these animals also showed pneumonia, pleuritis, and peritonitis at autopsy. Inflammatory and degenerative changes were also found in the viscera such as the liver, spleen, and kidneys. The joints became noticeably swollen in a few days after streptococcus infection and after from twelve to fifteen days with some of the mixed infections. Streptococci plus staphylococci and streptococci plus colon bacilli caused a more severe infection than any of these alone. On the other hand, streptococci plus pyocyaneus bacilli, staphylococci plus pyocyaneus bacilli, colon bacilli plus pyocyaneus bacilli, and colon bacilli plus staphylococci induced less virulent infections than any of these by themselves.

The association of tuberculous bacilli with pyogenic bacteria induced in the first infection an accentuated inflammatory reaction as compared with the controls. A second infection in these animals, however, resulted in chronic inflammation. The presence of pyocyaneus bacilli tends to make the other pyogenic bacteria disappear, as shown by the study of the bacterial colonies on plate cultures. Likewise in mixtures of colon bacilli and staphylococci, the former gradually disappear from the joint infection, as demonstrated by plate cultures. In mixtures of three bacteria the pyocyaneus bacilli causes the colon bacilli to disappear sooner than the staphylococci. In a mixture of streptococci, staphylococci, and pyocyaneus bacilli the staphylococci become inhibited, while the other two types of micro-organisms thrive.

The joints showed more effusion with staphylococci and pyocyaneus bacilli, than with colon bacilli or streptococci. In most instances the effusion contained lymphocytes and leucocytes; and in the cases with streptococci there were also erythrocytes. In chronic cases the inflammation subsided and granulation tissue was formed, which tended to invade the joint space between the bony articulations. The greatest inflammatory changes were found in the spongy bone tissue of the epiphysis. The periosteum was inflamed and thickened. In the presence of other pyogenic bacteria the streptococci inhibited the hemorrhagic and necrotic properties of the former.

It was found that a pyocyaneus infection superimposed on a previous staphylococcic or colon-bacillus arthritis had an inhibiting effect on the infection; this inhibition did not occur, however, when the pyocyaneus joint infection was primary. If a tuberculous arthritis is additionally infected with pyogenic bacteria the chronic tuberculous arthritis is transformed into an acute arthritis. If after a time the pyogenic invaders disappear the joint resumes the appearance of a chronic arthritis with fistula formation.

In conclusion the authors note that the association of streptococci and staphylococci, or streptococci and colon bacilli causes a more acute arthritis than any of these bacteria alone. The opposite holds true for any of these bacteria in mixed infection with pyocyaneus bacilli. The tubercle bacillus in mixed infection with pyocyaneus bacilli, staphylococci, or colon bacilli causes a more acute inflammation than when acting by itself. Staphylococci and streptococci show a synergism in their mutual action; pyocyaneus bacilli, on the contrary, exert an antagonistic effect in combinations with any of these bacteria.

JACOB E. KLEIN, M.D.

Logròscino, D.: Syphilitic and Tuberculous Syphilitic Osteo-Arthritides (Osteo-artriti luetiche e tubercolari-luetiche). *Chir. d. organi di movimento*, 1939, 25: 117.

Logròscino describes 4 cases of syphilitic osteoarthritis, which presented all the characteristics of tuberculous forms. He calls attention to some signs which often pass unobserved but are of practical value in making the correct diagnosis. These signs include: abortion in the mother of the patient or in the patient herself; cervical polyadenitis which may cover a considerable area but develops in a relatively short time; the area is symmetrical, remains mobile, and does not give rise to abscess formation; instead, there are small, serpiginous, irregular ulcerations covered with crusts formed by seropus and coagulated blood; previous acute pseudarthritides which are really the arthralgias of the second stage. The first manifestations around the joint consist of small nodular swellings, the course of which shows that they are gummatous formations that ulcerate through the skin, extend in depth, and involve the periarticular tissues: they may be associated with trauma and, because of their symptoms, be mistaken for ordinary staphylococcic osteomyelitis, but the subsequent appearance of various painless, tense, and elastic swellings, which on incision give issue to a serosanguineous fluid, will raise the suspicion of syphilis. Besides, the ulcerations present the typical syphilitic characteristics.

Diagnostic difficulties are offered by congenital or acquired syphilitic polyarthritis which may be of extremely varied aspect: usually, the diagnosis is based on the positive serological reaction of the blood or of the articular fluid and on the result of specific treatment. In a small number of cases, the spirochete may be demonstrated in the granulomatous tissue. The treatment consists of mercurial inunctions and, in resistant cases, persistent bismuth and iodide administration. Usually, articular mobility is impeded only by fibrous adhesions and cicatricial retraction of the skin and soft tissues, which may be improved by physical therapy.

The author also describes 5 cases of combined tuberculous and syphilitic osteo-arthritis. The rarity of the reports of this combination is probably due to diagnostic difficulties. The 2 infections are usually contracted at different times, and one infection predisposes the organism to the favorable reception of the other. In a limited number of cases, it is possible to demonstrate some sure signs of both infections, but in general there is a variable combination of manifestations. The signs of syphilis are the same as in the first series of cases. Particular attention must be paid to the aspect of the ulcerations of the soft tissues, and a dermatologist should be consulted in case of doubt. Grossly, the mixed forms of cutaneous ulceration are similar to those of syphilis and differ decidedly from those of tuberculosis, although there may be exceptions. The serological reaction is of undoubted value if positive, and of no value if negative, especially when other signs indicating syphilis are present. In old suppurating tuberculous processes in which the serological reaction is positive, the result of specific treatment will reveal whether syphilis is really present. Although histological examination of granulomatous tissue does not furnish any specific diagnostic proof for either disease, it should be done because the spirochete or tubercle bacillus may be discovered. Roentgen examination is helpful in a number of doubtful cases. The prognosis differs according to cases: it is favorable in those of recent syphilis, serious as to late results in frankly tuberculous or syphilitic forms, and grave in unrecognized cases. Anti-syphilitic treatment is of great value, especially from the diagnostic point of view, and it should never be neglected in doubtful cases; results are promptly obtained, but its advantages decrease markedly after three or four months, because the tuberculous process still remains active after the syphilitic factor has been eliminated; a long period of orthopedic sanatorial treatment will be required to cure the tuberculous process. Salvarsan may cause disturbances; therefore, the author's rule is to give from 30 to 36 mercurial inunctions followed by from 12 to 18 injections of bismuth; a series of injections of arsenobenzol to reach 6 gm. in adults may be intercalated. Antituberculous treatment is given at the same time.

RICHARD KEMEL, M.D.

Howard, N. J.: Acromioclavicular and Sternoclavicular Joint Injuries. *Am. J. Surg.*, 1939, 46: 284.

The treatment of clavicular joint injuries should not only be directed to the restoration of the normal relation of the structures involved, but also to restoration of the normal function. The clavicle, while acting as the principal support in preventing the shoulder girdle from collapsing on the thoracic cage, is entirely dependent upon its ligamentous attachments for its position. The wide range of motions in the glenohumeral and scapulothoracic joints usually prevents clavicular subluxations, but the clavicle is especially susceptible to a lateral thrust. When a complete acromioclavicular dislocation occurs, the clavicle not only is elevated but is displaced posteriorly as well. This is demonstrated by lateral roentgenograms. Replacement in these injuries is relatively easy but the difficulty lies in providing retention of the bones long enough for strong ligamentous repair.

Since 1932 the author has been using a modified brachioclavicular sling, which employs the principle described by Sir Robert Jones. This device has proved satisfactory in complete and incomplete subluxations of the acromioclavicular joint. The effectiveness of the splint depends upon immobilization of the arm at right angles, as it provides a fulcrum for effective upward traction of the arm and shoulder, and the use of elastic traction at the same time presses downward upon the clavicle. Motion is prevented for two weeks and then is usually permitted to prevent stiffening and contracture. The splint is used for from four to five weeks in complete

separations, following which the usual muslin sling may be used until elbow and shoulder motions are quite free and comfortable. Howard treated 30 cases of acromioclavicular injuries, 10 of which were complete dislocations.

Sternoclavicular dislocations were treated by a well fitting clavicular cross which was left on constantly for at least four weeks to permit normal tensile strength to be developed in the torn ligamentous structures. Three patients treated in this manner recovered with no false motion or tendency toward subluxation, and with an average disability period of fifty-four days. An oblique fracture of the inner end of the clavicle which split the joint surface and assumed the form of the usual sternoclavicular dislocation was treated with a clavicular cross with excellent results. SAMUEL B. SPIRA, M.D.

Laurell, H.: Shoulder Pains, Especially Following Slight Muscular Exertion, and Periarthritis Humeroscapularis (Ueber Schulterschmerzen, besonders nach geringer Muskelanstrengung, und ueber Periarthritis humero-scapularis). *Upsala Läkaref. Förh.*, 1939–1940, 45: 321.

Laurell calls attention to the right shoulder and arm as being the sites of special predilection for pains. This proves that right handedness in work and play has the dominant rôle in its production. These pains may vary in severity and location. At times pains are in the shoulder only (in a greater or lesser area) but often they radiate from shoulder to the neck and arm and even to the fingers, when they may assume a neuralgic character.

The author quotes many authorities in support of his views.

The causes of shoulder pains are manifold and difficult to establish even when roentgen plates are made. Arthritis, osteitis, tumors, traumatic fractures, calcareous deposits, and other pathology may be discovered. However, these are the unusual causes of shoulder pains. The patient's version is, "I don't know," "rheumatism," or "overstraining and coldness of the joint." Peritendinitis calcarea or myotendinitis calcarea is found rather frequently according to Sandstroem. The pathologico-anatomical changes described by Sandstroem and Wahlgren are: (1) necrosis and necrobiological changes in the tendons and adjacent musculature, ligaments, and joint capsules, as well as in the surrounding soft connective tissues; (2) vascular changes in the form of media-hypertrophy and thrombosis formation in the smaller arterial branches; (3) regenerative changes in the form of cell proliferation and formation of new blood vessels; and (4) inflammatory changes with cell infiltration around the blood vessels and in the granulation tissue. Pain and limited mobility in one or both shoulders often occur during maturity and senescence. Occasionally this condition can be traced to overexertion or trauma of the shoulder, but in an overwhelming number of cases no known cause can be established. The right shoulder is most frequently involved.

The patients usually are sent in for treatment, or referred to the roentgenologist with the diagnosis of periarthritis humeroscapularis or peritendinitis. In many instances the roentgen plates show calcareous deposits in the most sensitive areas, the tendons of the supraspinatus muscle, and, occasionally, evidence of a previous severe traumatism, as a luxation. As a rule, however, no certain changes that might cause the pain are discoverable in the roentgen films. Indeed, a diffuse or speckled atrophy of the caput humeri is sometimes observed, but this is most likely due to inactivity. Often many other significant roentgen findings are noted which, owing especially to the advanced age of the patients, might be regarded as the causes of the complaints. Not infrequently the roentgen plates show irregularities of the joint surfaces, also a cortical, irregular solidification of the upper part of the tuberculum majus.

Detailed analysis and exact study of the occupation of the patients before the appearance of the complaints proved that their work was preponder antly one-sided (automaton-like) and affected the shoulder involved by tiring and overstraining the joint. In the majority of cases the patient's work was a tiresome monotony of light or hard labor that necessitated lifting the arms. This caused a tonic contraction of the muscles that elevate the arm, especially the deltoid and supraspinatus, and at times also the trapezius and levator scapulæ.

According to Lindstedt and Helweg the muscles subjected to such unfavorable working conditions become sensitive, painful, and harder than normal. In addition, the function is diminished. The poor circulation and lack of proper oxygenation of the tonically contracted muscles interfere with lactic-acid function; the lactic acid remains too long and in higher concentration in the muscle and, hence, causes degeneration of the latter. Anyone can demonstrate by a simple experiment that severe and lasting shoulder pains result from tonic contractions of the muscles. All that is necessary is to extend the arm at right angles from the body and hold it as long as possible, even if it is painful. The pains radiate from the shoulder to the hand and sometimes from the neck to the shoulder; the sensitiveness remains long after this experiment is made.

A severe muscle strain may occur during light as well as heavy work. The type, duration, and intensity of the work, or the muscular strength required are not solely responsible for the pains; the condition of the blood and its circulation also come into play as important factors. If the patient is anemic and the circulation reduced, tonic contraction will tire the muscles more quickly. Weakened circulation may be due to various causes and is generally present during convalescence. Periarthritis is often a sequel of debilitating infections like angina and influenza as well as of obesity-diet cures, especially if the patient tries to do his usual work while dieting.

If a muscle is sensitive and hurts during motion the patient will try to immobilize the painful muscle

by prolonged contraction and extension of other muscles. This may cause sensitiveness and pains in the muscles acting for the relief of the original complaint. While working in the home or factory, during play and sports, one may sustain in addition to overstrain, repeated insignificant injuries in the region of the tendon of the supraspinatus muscle. This area, because of its anatomical relations, is easily traumatized by ischemia, pressure, and blows.

The inwardly rotated arm cannot be abducted much over 90 degrees on account of pressure of the tuberculum majus against the acromion. The tendon of the supraspinatus muscle and its contiguous parts are then subject to a pressure which will produce more or less ischemia. The sawing motion of the arm in this position easily causes a pressure or a grinding of the subacromial soft tissues between the caput and the acromion. Carnett and Case claim this to be the cause of a gradually developing degeneration of the tendon which may lead to rupture of the tendon during even light labor in advanced age when it may be regarded as an almost normal condition (Codman, Lindblom, and Palmer). Calcium deposits are often found in the degenerated tissue. If a roentgenogram is taken of such a diseased shoulder during maximal abduction of the arm, the calcium deposits will be seen wedged between the tuberculum majus and the acromion. According to Schaer arthrosis deformans of the shoulder-joint usually follows in cases of tendinitis calcarea; but the author believes abnormally violent labor or trauma may produce the same results.

The clinical picture of periarthritis humeroscapularis may be produced by many causes of which the author has enumerated only the most common, such as labor in unfavorable postures, or in poor environments. For more detailed study the author refers to Schaer's excellent monograph which also contains a full bibliography. The author's paper is intended to call attention to abnormal conditions produced by factors not studied nor even noticed by the majority of authors.

The recognition of the cause of periarthritis humeroscapularis presupposes a rational therapy and prophylaxis of this disease which is of momentous importance to accident insurance companies and workmen's compensation.

MATHIAS J. SEIFERT, M.D.

Mustakallio, S.: Periarthritis Humeroscapularis; Particularly Its Treatment with Roentgen Irradiation (Ueber die Periarthritis humeroscapularis und besonders ihre Roentgenbehandlung). *Acta Soc. med. Fennicae Duodecim*, 1939, Ser. B., 26: Fasc. 2.

The author employs the term "periarthritis humeroscapularis" to include all of the "arthritic" conditions, both traumatic and inflammatory in origin, which may affect the region of the shoulder joint. This joint really consists of two articulations: (1) articulatio humeroscapularis, and (2) articulatio acromioclavicularis. Either of these or both may be affected by various inflammatory processes arising within the articulation itself, or they may become involved in any of the periarthritic conditions.

Arthritic involvement of the shoulder, which is not infrequently the seat of arthritis deformans, often produces clinical symptoms similar to those produced by periarthritis. The former, however, does not produce limitation of motion in the shoulder joint, and is more typically characterized by sharply defined tenderness limited to this articulation.

The occurrence of calcium deposits in the region of the shoulder joint has been recognized and well known since the end of the last century. However, the occurrence of calcific deposits, even when confirmed by roentgen-rays, need not necessarily give rise to clinical symptoms, i.e., limitation of motion and pain. The author believes that a division of the periarthritides of the shoulder region into groups, based on the absence or presence of calcareous deposits, is arbitrary. According to his opinion, all of the periarthritides have a similar causative origin.

The periarthritides of traumatic origin, however, form a distinct group; but even this group is closely related to the non-traumatic forms. The traumatic periarthritides may arise as the result of very minute trauma. According to Seifert the latter can lead to the formation of a subdeltoid hematoma or rupture of the capsule. The organization of the hematoma or the traumatic inflammation then leads to the formation of adhesions between the articular surfaces of the shoulder which is held immobile and in adduction. According to Boehler the long head of the biceps muscle, lying in the sulcus intertubercularis, is frequently injured by trauma, and adhesions form between the tendon and the surrounding structures. Attention is called to the sharply delimited tenderness at the points of insertion of the various muscles, which is a characteristic finding in the periarthritides.

The author discusses the various forms of therapy advocated in the literature for the different forms of periarthritis humeroscapularis both in the acute and chronic stages. He believes that short-wave diathermy is a valuable adjunct. More recently active motion has been strongly recommended. In severe cases the shoulder should be fixed in abduction for several days and then active motion should be instituted. This discussion is followed by a detailed review of the author's own experience with roentgen therapy in a series of 200 cases treated at the Finnish Red Cross Hospital. Of these cases 113 could be traced in a follow-up study, in which cases the average age was about fifty years. The material was divided into four groups; acute, chronic, and traumatic periarthritis, and arthritis of the acromioclavicular joint. In each group more females than males were affected, and more persons engaged in intellectual occupations than physical were involved. Most of the patients with periarthritic conditions presented themselves for treatment after reaching the chronic stage of the disease. The right shoulder was most frequently affected (70 per cent) and most of the patients had limitation of motion in the

affected shoulder at the time when treatment was begun.

Roentgen examination revealed no demonstrable pathological changes in the shoulder joint or its immediate vicinity in most of the cases of periarthritis humeroscapularis. The most common positive finding consists of the appearance of calcific shadows in the periarticular tissues. Somewhat less frequent are small periosteal bone thickenings or spur formations at the tip of the tuberculum majus; concomitantly one frequently finds spots of absorption of calcium in the bone in this region. Changes characteristic of arthritis deformans are usually found in the acromioclavicular articulation.

The various methods of roentgen therapy and the various dosages advocated in the literature are discussed. In the author's series two doses of 150 roentgens given three days apart usually sufficed; in the other groups the number of treatments was somewhat greater. Of the cases of acute periarthritis 6 of 15 were cured during the first week. In the other groups the results were markedly poorer. After three weeks the number of cures in the various groups of periarthritis were as follows: in the acute, 11 of 15; in the chronic, 24 of 52; in the traumatic, 8 of 35; and of the cases of arthritis acromioclavicularis only 1 of 11 was cured. After one-half year 71 of the 113 patients (63 per cent) in all of the groups had recovered. If we take into consideration all of those cases which only showed improvement following roentgen therapy, we find that practically all of the cases either showed improvement or were cured after one week. At the time of the follow-up inquiry there were 100 per cent which were cured or showed improvement in all of the groups except the chronic. In the latter group 49 of 52 (94 per cent) either were cured or showed improvement.

Of the cases reported cured after one-half year the chronic group of periarthritis had the greatest number of relapses. Relapse was rare in the other groups. Most of the cases were cured by roentgen irradiation alone without recourse to any other form of therapy. In most of the mild cases it is best to institute roentgen therapy and at the same time encourage the patient to actively exercise his shoulder. Hospitalization is recommended for all of the severe cases. HARRY A. SALZMANN, M.D.

Diack, A. W., and Trommald, J. P.: DeQuervain's Disease. A Frequently Missed Diagnosis. *West. J. Surg., Obst. & Gynec.*, 1939, 47: 629.

During the past year the authors have treated 5 cases of DeQuervain's disease and believe that this syndrome should be reviewed again.

DeQuervain described a stenosing tenovaginitis of the abductor pollicis longus and extensor pollicis brevis tendon sheaths at the radial styloid process. The disease produces tenderness and pain at the radial styloid, a painful thumb, and, usually, incapacity of the affected hand.

The anatomy of the affected tendons is reviewed. In this disease the tendon sheath is always thickened at the radial styloid and the enclosed tendons are restricted in their motion by the narrowing of the sheath lumen. The pathological changes vary from effusion within the sheath with edema of the sheath wall through increased vascularity and thickness of the fibrous portion of the wall, to marked thickening of the dense fibrous layer with hyaline degeneration. Fibrinous exudate with roughening of the tendon surface has also been described. At times the involved tendons may show a fusiform enlargement and in some even fraying.

The disease is apparently due to trauma, more often chronic than acute. It may occur in workers whose occupations require repeated abduction of the thumb under stress or grasping motions combined with adduction of the wrist. By far the greater number of cases have been reported in women. There is no predominance of either hand.

The usual complaint is pain about the styloid usually with radiation up the forearm and into the thumb. The pain is often disabling and may prevent work or sleep. The most painful motions are extreme adduction of the wrist or extreme abduction of the thumb. In all cases there is tenderness over the radial styloid process and usually a palpable tumor of bony hardness. The differential diagnosis should exclude arthritis, neuritis, tuberculosis, non-specific tenosynovitis, and fractures about the styloid process. Roentgen-ray examination is of help in ruling out these conditions, and occasionally there will be found periosteal reaction and an increase in the soft tissue shadow about the styloid.

Conservative treatment consists of six weeks of immobilization of the wrist and the abducted thumb in a plaster cast. Statistically this is successful in 70 per cent of the cases. Operation, however, has universally resulted in a cure and because of its simplicity and short convalescent period it is considered the treatment of choice. The incision is made directly over the styloid tip and dissection is carried down to the affected tendon sheath. The accepted procedure is to excise the thickened "roof" of the tendon compartment at the point of constriction, although simple incision of the sheath suffices. The wound is closed without any attempt to reconstruct the sheath. The dressings should hold the thumb abducted and mild active motion may be started on the second day. Within a week the patient has recovered.

The histories and treatment of 5 cases are reviewed. HARVEY S. ALLEN, M.D.

Selig, S., and Arnheim, E.: Scoliosis Following Empyema. *Arch. Surg.*, 1939, 39: 798.

The authors studied 65 patients who had pyogenic non-tuberculous empyema in an effort to determine the factors which result in persistent scoliotic curves in some and no permanent spinal deformity in others under apparently similar circumstances.

Chandler observed that in nearly all cases of acute empyema a temporary mild scoliosis develops. Of the 65 patients studied for this report only 5 pre-

sented clinical evidence of a persistent scoliosis. The curvature was marked in 2 of the 5 cases and mild in 3. Sixty patients showed no evidence of scoliosis. None of the 52 patients with acute empyema whose wounds healed permanently within four months had persistent scoliosis. Five of the 13 patients with chronic empyema requiring multiple operations, rib resections, and excisions of the soft parts developed persistent scoliotic deformities. These 5 patients developed empyema before the age of thirteen.

There are two main types of scoliosis that develop following intrathoracic disease. In the scoliosis that follows empyema the concavity is toward the empyema and there is little or no rotation of the vertebral bodies. In scoliosis complicating thoracoplasty the convexity is toward the resected ribs. There are exceptions to the rule, however, and the early curve may be convex on the side of the empyema if there is an extremely massive effusion. The curve resulting from thoracoplasty almost always has its convexity on the surgically treated side but may be influenced by the pre-existing opposite curve caused by the empyema. Occasionally the two curves neutralize each other, and scoliosis following empyema with the concavity on the diseased side disappears after thoracoplasty. In 2 of the 5 patients who showed persistent scoliosis, it followed thoracoplasty and presented a thoracoplastic type of curve, and in 3 it followed multiple rib resection and presented a postempyemic type of curvature.

Persistent scoliosis frequently occurs as a complication after extensive operations on the thoracic cage for chronic empyema in children, and surgeons should take prophylactic measures against its occurrence because treatment of the scoliosis is futile. The reasons for the appearance or non-appearance of persistent scoliosis are not apparent. Persistent scoliosis is not a complication of acute empyema.

ROBERT P. MONTGOMERY, M.D.

Brofeldt, S. A.: The Clinical Significance of Sacralization (Ueber die klinische Bedeutung der Sakralisation). *Acta Soc. med. Fennicae Duodecim*, 1939, Ser. B., 27: Fasc. 1–2.

The clinician is particularly interested to know whether the inclusion of the last presacral vertebra in the closed bony mass of the sacrum (sacralization) can produce pains and disability and in what manner such pains can be produced. Even normally the last presacral vertebra bears broadly formed transverse processes, which often show a small prong on the lower edge. This represents the first beginning of an anlage of the lateral masses, which develop on the vertebra that fuses with the sacrum. Sacralization may show all the various transitions between this condition of the slightest development of a lumbosacral transitional vertebra and a fully formed vertebra fused with the sacrum.

Meyer-Borstel proposes the following classification of these variations: (1) unilateral or bilateral incomplete sacralization, in which the transverse process is hypertrophied, similar in form to a club or the wing of a butterfly, and without contact between the transverse process and the lateral sacral mass or the iliac crest; (2) bilateral osseous sacralization, in which both transverse processes show bony fusion with the sacrum; (3) bilateral articular sacralization, with a nearthrosis between the transverse processes and the sacrum; (4) a bony fusion on one side and articular fusion on the other; (5) unilateral bony fusion; and (6) unilateral articular sacralization. This classification is generally accepted, but the anatomical and clinical concepts are entirely different and should be differentiated. Even the roentgenogram may be deceptive, depending upon the technique of the exposure.

The reported frequency of sacrolumbar transitional vertebræ varies between 1.8 and 10 per cent, and in cases with pain in the back the figures are much higher (25 to 60 per cent). Ingebrigsten figures the frequency of sacralization at most at 5 per cent, and this figure seems to correspond with necropsy findings. The numerous roentgenological diagnostic failures seem to increase the frequency of sacralization and its clinical significance. Some authors flatly deny any significance to the pain in lumbodorsal assimilation. There is still much discussion as to what forms of sacralization have pathological significance. Today it may well be said that the concept "painful sacralization" has been applied to certain forms of sacralization, but no conclusion has been drawn as to the nature of the changes in the lumbosacral area or the cause of the pain.

After discussing the various theories advanced by different authors as to the causation of the pains in sacralization, Brofeldt draws the following conclusions, based upon 44 cases observed by himself:

The sacrolumbar transitional vertebra shows not only changes in the fusion of the hypertrophic transverse process with the sacrum, but even primary variations and similar asymmetries in the transverse process, also in the intervertebral disc, the intervertebral joints, and in the form and position of the vertebra. Of special clinical importance are the variations in the vertebra, that are associated with an oblique position of the lower horizontal supporting surface of the vertebra. The unsymmetrical weight-bearing produced by this oblique position produces changes in the often previously unsymmetrically arranged joints and nearthroses, arthroses, and scleroses and, finally, ankyloses as a result of marked proliferations of the borders. If these asymmetries are produced not only by an asymmetrical sacralization, they may also appear in the various forms of the bilateral sacralization and give rise to these unfortunate oblique positions. Therefore one may encounter a painful sacralization in all its forms. This fact indicates that the sacralization in itself, as well as the nearthrosis and the scleroses in the nearthrosis, has a very limited significance in the production of pains. Nerve compression probably rarely needs consideration, although it cannot be excluded entirely. In most of the cases of asymmetrical sacralization there occurs

in the course of years an extensive accommodation of the joints to this oblique position. The osteoarthritic changes (nearthroses) should also be considered as a sort of attempt at consolidation. These may produce pains in the initial stages in young persons, but in later years the hypertrophied borders render the joints immobile, and the pains gradually lessen.

The clinical picture is just as varied as the anatomical changes in the transitional vertebra. It may even be impossible to make more than a probable diagnosis on the basis of the clinical examination alone. The patients are persons often between twenty and thirty years of age, and at this age women are more often affected than men. Not rarely they have had a weak back previously. The history not rarely shows slight attacks of sacral pains or sciatica. The symptoms vary in the slight and severe cases. In the former the patient moves freely and complains only about weakness of the back after exertion. The spine is often slightly scoliotic and the musculature of the back is only moderately tense. The backward movements of the back are normal, but motion is limited somewhat anteriorly and also on the painless side. The points of pain often lie in the region of the small lumbosacral joints bilaterally. Painful points in the sciatic region are rare, but subjective neuralgias in the lumbosacral and sciatic areas are observable. The Lasègue sign is positive in from 60 to 70 per cent of cases. In acute cases of lumbago and in severe chronic cases the patient often cannot walk at all or only with a limp and short steps, bent forward, and with support of the back and hips; there are often marked, unilateral pains in the back and sciatic neuralgias; the back is often markedly scoliotic and the back musculature shows marked spasticity; movements in the lumbosacral region are impossible, the back is immobile, and bending forward is possible only in the hip. The Lasègue sign is positive on the painful side or bilaterally. The muscular insertion of the sacrolumbar muscle on the iliac crest is very tender. There are no pathognomonic symptoms. The diagnosis can be made only by roentgenography, but not without a careful clinical examination as there may be no clinical symptoms at all, and even a painful sacralization may become asymptomatic by consolidation processes.

A disease with such varied causes cannot be relieved by a single form of treatment. Besides, the painful periods are often transient. Hence conservative therapy is indicated. Rest in bed and immobilization of the back are very helpful. In severe cases with spastic contracture and a tender iliac crest, the acute pain may be relieved by novocaine injections at the site of insertion of the sacrolumbar muscle. The spasticity may be relieved by roentgenotherapy and bed rest, followed by a low plaster corset for from six to eight weeks. In less severe cases the latter may be replaced by a short corset or supporting elastic belt around the pelvis. The operation of resection is rarely indicated. In the few cases in which conservative therapy fails the pain is often due to a spondylarthrosis or spondylosis that has not been put at rest. In these cases the operation of fixation of the lower lumbar and lumbosacral joint according to the method of Albee, Hibbs, and Verall is indicated. LOUIS NEUWELT, M.D.

Zur Verth: Foot Injuries (Fussverletzungen). *Ber. 8. internat. Kongr. f. Unfallmed. u. Berufskrankh.*, 1939, 2: 540.

The significance of this type of injury lies in its sequelæ in the matter of weight-bearing; any form of external trauma may result in complete functional breakdown of the foot. The acute, severe external traumatic effect is the primary factor. The secondary cause of the disability in such severe pedal traumas does not as a rule reside in a faulty method of fixation so much as in premature weight-bearing. Such failure is observed likewise as a result of forcible spreading of retaining joint-function in cases of simple fractures, such as those of the external malleolus. The external traumatizing force which produces the fracture may at the same time cause severe disturbances of function with the production of pes cavus and thickening of the tarsal bones.

The inlay is better in these cases than the orthopedic shoe; the best inlays today are those made from light metal and welded to fit the individual foot. Even when the mechanical violence of the trauma has not been so great, an osseous dystrophy may develop as a result of minor influences of various sorts. The grade of the bony changes depends on the intensity of the irritative effects—which may be of mechanical, chemical, thermal, or even of bacterial character—and upon the general or local irritability of the person affected; the severity and persistence of the loss of function frequently offers marked contrast to the mildness of the cause. Treatment consists of the orthopedic inlay, elastic bandages, and conservative, active use of the foot.

Of even greater importance is the reactive capacity of the individual in contracture of the foot. This deformity arises as a result of the foot's being kept in supination from fear of pain in cases such as those in which there is a sore under the ball of the great toe, or as the end-result of tic-like convulsive movements, but it may develop even on a hysterical basis.

The contracted flat-foot likewise presupposes the presence of nervous lability in the injured person, in addition to the effects of the external violence.

Treatment of these conditions does not offer a great deal.

(HEINEMANN-GRUEDER). JOHN W. BRENNAN, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Cholmeley, J. A.: The Distribution and Treatment of Extra-Articular Foci in Tuberculous Arthritis of the Hip Joint. *Brit. J. Surg.*, 1939, 27: 224.

In this article, a series of 55 cases of early tuberculosis of the hip is reviewed, presenting cases in

which the roentgenographic evidence showed only an extra-articular focus of involvement. The most common focus was found to be in the medial half of the acetabular roof and the next most common in the femoral neck.

Twelve cases were treated by excision or curettage of the primary focus, and the remaining 43 were treated purely conservatively. In 11 of the 12 treated by excision, subsequent involvement of the hip joint occurred; the 1 case in which the joint remained free of the disease presented a lesion in the region of the greater trochanter, from which a large abscess was evacuated. Of the 43 patients treated purely conservatively, only 3 remained free from disease. It is seen therefore that no significant difference exists between the ultimate results obtained in the two series.

DANIEL H. LEVINTHAL, M.D.

Wilson, P. D., and Thompson, T. C.: A Clinical Consideration of the Methods of Equalizing Leg Length. *Ann. Surg.*, 1939, 110: 992.

In all ages and by all races, inequality of leg length has been regarded as a disgraceful and crippling affliction. The disability resulting from it varies and is directly proportional to the amount of difference in the length of the two limbs. An individual who is otherwise normal can generally compensate for a discrepancy of as much as 1 in. by tilting the pelvis and walking with one hip higher than the other. When the difference is greater than this, a lift should be inserted under the shoe or an excessive curvature of the spine will be produced and symptoms of strain and fatigue may result. For a discrepancy of from 2 to 3 in. a cork insert under the shoe is fairly satisfactory. When the shortening exceeds 4 in. a metal patten must generally be used, and in extreme instances a wooden prosthesis constructed after the manner of an artificial limb.

Inequality of leg length often produces a bad psychological effect, as the raised shoe is conspicuous whether walking or sitting. Every boy or girl demands that something be done to rid him of what is considered to be a badge of ignominy. The cost is an important factor when one considers the expense of specially built shoes during a lifetime, and the elevation of the shoe is apt to increase the instability of the already crippled extremity. Its weight is also objectionable in the case of individuals with partially paralyzed muscles or disabilities of the joints.

Although considerable pressure is often brought to bear upon the surgeon to correct inequality of leg length, he should never permit sentimental reasons to overcome his surgical judgment. An elevated shoe often affords the best solution of the problem. Careful observation of a patient's gait with a raised shoe should always precede any decision as to operative treatment. In crippling conditions, shortening is often only one of several factors responsible for the disability or limp. Ankylosis or deformity of the hip, knee, or foot, or muscle weakness may be more disabling factors than the shortening and should receive appropriate treatment. Equalization of the leg length when such other factors are ignored is likely to prove disappointing.

Discrepancy in leg length may be due either to retardation of growth in the short extremity or to overgrowth of the long one. Sometimes the same pathological condition may cause shortening in one individual and lengthening in another. Tables are presented listing the common causes of inequality of leg length, the pathological conditions associated with lengthening of an extremity, the pathological conditions associated with shortening of an extremity, the different ways of dealing with instances of unequal leg length by surgical procedures, approximate proportional growth at the various epiphyses of the lower extremity, reported results of leg-lengthening from the literature and of cases from the Hospital for Ruptured and Crippled, also, reported results of leg-shortening from the literature, and a comparison of methods of equalization of leg length. Case reports including roentgenograms, photographs, pre-operative and postoperative measurements, a historical résumé of the development of the various methods of equalizing the length of extremities, a written and diagrammatic sketch of the operative technique for epiphysiodesis, and an extensive bibliography are given.

Local stimulation of bone growth has not as yet been proved sufficiently successful to warrant clinical application. Lumbar sympathectomy, when indicated for the correction of circulatory disturbances in association with inequality of leg lengths, as frequently seen in poliomyelitis, may be expected to cause a favorable alteration of the diminished growth rate of the shorter extremity. However, even when done before the patient is nine years of age, improvement cannot be assured, and the greatest gain that can be expected is approximately 1 in. Epiphyseal arrest in comparison with the other operative methods has the advantage of being a relatively minor surgical procedure. Few, if any, complications need be anticipated. Careful calculation is necessary to determine the age at which the operation should be performed, and which epiphyses should be fused. This depends upon the age of the patient when first seen, the amount of shortening, and whether or not it is increasing. When a gross discrepancy of length is to be overcome, the operation must be performed early. Each patient must be considered individually and a decision made upon the basis of the previous rate of growth and the expected growth in the extremities, as well as age, height, and leg lengths. Measurements of the patient's family are also of definite assistance. With these considerations in view, and the fact that practically all adults are between 5 and 6 ft. in height, with a leg length of from 30 to 38 in., it is possible to arrive, with a fair degree of accuracy, at a figure which will represent the expected length of the longer extremity at maturity. Subtracting the present leg length from this figure gives the expected amount of growth in this leg if no treatment is undertaken. Complete fusion must be obtained in order to avoid any danger of later de-

formity due to asymmetrical growth. This method offers the simplest and safest means of equalizing the leg lengths. Its only drawback is that its application is limited to the growing period.

Leg lengthening is a formidable procedure and is attended by serious complications which may still further impair the function of an already crippled leg. Previous infection of one of the bones of the leg to be lengthened should be considered an absolute contraindication, no matter how long it appears to have been healed. Lengthening operations are performed more frequently for shortening resulting from poliomyelitis than from any other condition. Yet it is precisely in such cases that the results are likely to be the most unsatisfactory. Not only are partially paralyzed muscles apt to be still further weakened by stretching, but the small atrophied bones are made still smaller and more brittle by elongation. The full consequences of bone-lengthening operations under these conditions are not revealed except by prolonged follow-up studies. From their observations the authors believe that bone-lengthening operations should not be performed until growth is well established, and then only when the musculature of the leg is normal or approximately normal. In general these operations should be reserved for individuals of short stature who are unwilling to make any sacrifice of height by shortening of the longer leg.

Leg-shortening, like epiphyseal arrest, has the disadvantage that it must be undertaken on the longer and usually normal leg. It is a relatively simple and safe procedure. The preferred techniques are resection of a portion of the shaft with fixation by an intramedullary graft, or a simple overlapping operation with fixation by pins. Serious infection, non-union, deformity, and muscle weakness have not been reported. Although the operation has been performed almost exclusively upon the femur, it has also been undertaken successfully in the lower leg. The maximum correction so far reported is approximately 3 in. Leg-shortening should be advised only when growth is well established. Many patients show an aversion to loss of stature, but the elimination of the raised shoe more than compensates for this. Furthermore, it should be pointed out that a lowering of the center of gravity in a patient with a crippled lower extremity usually results in a gain of stability and an improvement of locomotion. Leg-shortening, therefore, has the advantage over leg-lengthening, in that it actually improves function.

ROBERT P. MONTGOMERY, M.D.

FRACTURES AND DISLOCATIONS

Gissane, W.: The Treatment of Open Fractures. *Brit. M. J.*, 1939, 2: 983.

This article concerns the treatment of compound fractures, with particular reference to war injuries. The first essential is the creation of an effective organization to deal with each stage and to coordinate the entire period of treatment. The four guiding principles formulated by the Interdepartmental Committee on Fractures of the British Medical Association were (1) segregation; (2) unity of control; (3) careful after-care; and (4) establishment of rehabilitation centers. These principles are essentially the same as those advised by Robert Jones during the Great War.

For first aid the splint used must be efficient and simple, easily transportable, and allow easy access to the wound. Only two splints are advocated: for the arm, the swivel-ringed Thomas splint; and for the leg, the Thomas knee splint. Occasionally the Jones abduction frame, a modified Thomas hip splint, is required for hip and high femoral fractures. Shock is combated by the early gentle application of a splint under ⅓ gr. of morphine, followed by hot fluids by mouth, external heat, and, if possible, a period of rest. A dressing of 1-2,000 enflavine is recommended. Prophylactic injection of tetanus and gas-gangrene antitoxin should be made.

Early débridement is advised, before eight hours have elapsed after the injury if possible. All dirt, débris, and dead and devitalized tissues are removed. Wounds treated within the eight-hour period are closed either by suture or skin graft. Reduction is then performed gently and immobilization in plaster whenever possible, the Orr principle of leaving the wound undisturbed thus being used. This method with complete and prolonged rest offers the best outlook for the prevention of infection.

If treatment has been delayed until obvious infection is present, the wounds should be explored, all foreign matter removed, and adequate drainage established. Because of the danger of severe secondary hemorrhage and gas gangrene, such cases are transported to the base hospitals in the Thomas splint.

DANIEL H. LEVINTHAL, M.D.

Krohn, F.: The Treatment of Calcaneus Fractures and its Results, and a Follow-Up Study of 21 Heel-Bone Fractures Reposited with Boehler's Apparatus (Die Behandlung der Calcaneus-frakturen und ihre Erfolge und Nachuntersuchung von 21 im Boehlerschen Schraubenzugapparat reponierten Fersenbeinbruechen). Freiburg i. Br.: Dissertation, 1939.

The author gives a survey of the methods used in the treatment of calcaneus fractures up to the present time, and reports the results of a follow-up study of 21 fractures of the os calcis reduced according to the Boehler method and apparatus. This procedure has been in use since 1939 at Fromme's Clinic, and re-setting was performed from eight to seventeen days after the accident, usually under lumbar anesthesia and less frequently under general narcosis. Local anesthesia was used only in 2 instances. Kirschner wires were used throughout. The wires produced a slight cut in the skin in 1 case, a superficial necrosis in a second, and a slight infection in a third case. In 1 case only did it become necessary to remove the wire ahead of time on account of a more serious ulceration; in no case did osteomyelitis or general infection develop.

With the exception of 1 case, a wire drawn through the tibia was used for the suspension of the lower leg in connection with a sling made of gauze bandage, applied in 8 thicknesses over the lower third of the lower leg, and heavily coated with an ointment in places coming in direct contact with the skin. In stretching obliquely downward and posteriorly, the tension never exceeded 30 kgm.

After restoring the normal angle of the calcaneus tuberosity, and partially equalizing the contraction, Boehler's calcaneus-clamp was used for further elimination of the remaining contraction. Immediately after restoration of the normal form of the calcaneus, a dorsal plaster brace was fitted and indented on both sides to hold the wires. The forefoot was put into slight plantar flexion and pronated, and several plaster bandages were applied circularly, leaving the point of suspension open. After hardening of the plaster, the tension upon the heel-bone was removed, the gauze bandage pulled out, and the open space covered with plaster. The leg was then placed upon a Braun frame, and the bandage split from the front, lengthwise. Up to the time of its removal, the Kirschner wire was weighted with from 2 to 3 kgm., pulling obliquely downward and backward. The wire and plaster remained in position for from three to four weeks.

After a period of sixty days, the patient was fitted with an ambulatory plaster bandage and allowed to put his weight on the limb; after one hundred days he was permitted to get up with an elastoplast bandage, which type of bandage has been in use since 1931.

Among the 22 injured patients, 6 had suffered fractures of both calcanei; in 4 both calcanei were replaced with the apparatus, bringing the number of fractures treated with Boehler's apparatus to 26. Seventeen patients were examined later, and the condition of 1 had to be judged merely from the reports of the Co-operative Association. Among the 4 patients not followed up, 1 had sustained fractures of both heel-bones, which left 18 who were treated with Boehler's apparatus. In the follow-up examination roentgenograms were taken of the lateral and plantar sides of both calcanei.

In 14 cases accident compensation was paid; 6 injured persons were able to return to work for part time after six months. After nine months 2 were still unable to return to work, 1 of them having suffered a bilateral calcaneus fracture and a shattered lateral meniscus; the other of these 2 patients had been 70 per cent disabled before the heel-bone fracture occurred. One year after the injury, accident compensation of 50 per cent and more was necessary in 5 cases. Among 7 injured patients with unilateral calcaneus fractures, 2 were not entirely able to resume work after five years, and both received accident compensation of 20 and 25 per cent, respectively, which was discontinued after six years for one, and after seven years for the other. Three patients injured with double fractures without injury to other bones received 40, 50, and 60 per cent respectively, in accident compensation after one year; after two years they received 20, 30, and 50 per cent, respectively. In the first case the compensation was discontinued after the third year, and the second case could not be followed; the third patient was still receiving 40 per cent insurance compensation six years after the accident; this patient had suffered a bilateral injury.

Anatomical and functional results rarely correspond after reposition of calcaneus fractures. It was confirmed that the length of treatment does not depend directly upon the bone injury or the successful reposition, but rather upon the condition of the joint between the talus and the calcaneus. Frequently there are arthritic changes, since even after the most careful reposition of serious fractures a certain incongruity of the joint surfaces of the talus and the cuboid bone remains. The resulting arthritic discomforts may appear even several years after the injury. The more perfect the reposition and following fixation up to the time of complete recovery, the better are the chances for the prevention of arthritis. In cases of serious arthritis in the lower ankle-joint, arthrodesis should be considered more often than is usually the case; however, this procedure is not justified in recent cases, unless reposition of the fragments is supplemented by tenotomy. Tenotomy of the tendo calcaneus has never been carried out at Fromme's Clinic. (Bode). Hilda H. Wullen.

Gérard-Marchant, P.: Fractures of the Plateaus of the Tibia (Fractures des plateaux tibiaux). *Rev. d'orthop.*, 1939, 26: 499.

Gérard-Marchant defines the tibial plateaus as the bony surfaces of the tibia closest to the condyles of the femur; thus, there are two plateaus, an internal and an external, rather than one. The two are separated by the spines, and below each plateau is a tuberosity of the tibia. In fracture of the tibia, the tuberosities are more frequently involved than the plateaus; fractures of the latter are due to indirect rather than direct trauma.

In fractures involving only one plateau, separation fractures without displacement of the fragments can be treated by closed reduction; walking can be allowed in six weeks. In fractures of this type with displacement of fragments, open reduction and fixation with a screw or pin is necessary in certain cases; this depends upon the degree and direction of the displacement. In marginal fractures closed reduction and immobilization in plaster for about a month is usually sufficient. In transverse displacement of the fragment open reduction is indicated. In sagittal fractures if the fragment is displaced downward, closed reduction by traction is usually effective; open reduction with the use of screws or pins is reserved for those cases in which the fragments cannot be maintained in satisfactory position by traction. In cases in which fragments are impacted, open operation is usually indicated with the use of bone grafts.

In cases in which both plateaus are involved, satisfactory reduction can be obtained by manipula-

tion if the displacement is slight. With a greater degree of displacement, traction is preferable for closed reduction. In some cases of this type in which closed reduction is possible, results are found to be better if the open method with the use of the pin is employed.

In comminuted fractures, immediate reduction by orthopedic methods and immobilization are indicated, as in these serious cases, open operation is not usually advisable at the time of the trauma. Later an operation to improve the function of the joint can be carried out as indicated. If a fragment has entered the joint an arthrotomy should be done; in cases of ankylosis, some authors advocate resection.

In treating fractures of the plateaus of the tibia it is essential to remember that these fractures involve the joint, and that the method of treatment adopted must aim to maintain the joint function.

ALICE M. MEYERS.

Coggi, G.: A Case of Plantar Tarsometatarsal Dislocation (Un caso di lussazione tarso-metatarsica plantare). *Chir. d. organi di movimento*, 1939, 25: 25.

Coggi describes the case of a man who, while riding a motorcycle, was struck on the dorsum of the tarsal area of the right foot by the fender of an automobile travelling in the opposite direction. Inspection of the foot showed, besides swelling and various abrasions, reduction of the plantar concavity and of the length of the foot. Palpation disclosed a step-like depression at the medial tarsal area and pressure caused severe pain, while movements of the foot were limited and painful and those of the toes impossible. Roentgen examination revealed plantar luxation of the first cuneiform bone on the scaphoid and of the second and third metatarsals on the second and third cuneiform bones. Manual reduction having been found impossible, a steel wire was passed through the heads of the metatarsals to exert a traction of 20 kgm., while another wire passed through the calcaneum served to provide the counterextension. The traction was well supported and reduced the luxation gradually: two weeks after the accident, a plaster cast was applied incorporating the wires, and the extension apparatus was removed two days later. Finally, the wires were extracted, twenty days after their introduction. The result was satisfactory.

Quénu and Kuess have divided the foot into two parts: the postero-internal, including the entire tarsus and the first metatarsal bone, which form the arch of force and of movement of the foot; and the antero-external, including the 4 remaining metatarsals, which provide support for the foot. They have classified luxations of the metatarsus into total homolateral or homotropic, in which the first cuneiform bone may remain attached to the first metatarsal and accompany the latter in its displacement; heterolateral or heterotropic; and isolated. Although all of the metatarsals were not dislocated, the present case is considered as belonging to the first class. Total external dislocations are the most common; plantar dislocations are rare and mostly of the first metatarsal alone. Plantar luxation may occur by direct mechanism through forced dorsal flexion of the foot or through external rotation of the foot with torsion, and by indirect mechanism through downward force applied directly to the metatarsus. The rarity of these dislocations and the severity of their symptoms make roentgen examination indispensable; but this should not be a reason for the neglect of methodical examination by manual verification of the relations of the different bones and by comparative measurements of the length of the metatarsals of both feet. Usually, a dorsoplantar roentgenogram shows clearly the bones of the tarsus and the heads of the metatarsals, but additional plantodorsal and external and internal lateral films may be found advisable.

The prognosis of untreated cases is not bad as the patient's foot gradually adapts itself until satisfactory function is re-established. In recent cases, reduction must always be attempted as soon as possible, preferably under general anesthesia, and must aim at reconstruction of the so-called internal column on which the restitution of function depends principally. Surgical reduction is reserved especially for irreducible first metatarsals. In old cases, it is advisable to abstain from any intervention: when severe disturbances of function make operation necessary, conservative resection is indicated, but it should never involve the proximal epiphysis of the first metatarsal because of the tendinous insertions of the anterior tibial and lateral long peroneal muscles.

In the present case, the plaster cast was removed thirty-five days after the accident because of extensive decalcification of all the bones of the foot, the cause of which could not be discovered. However, cautious movements of the foot and gradual habituation to support of the weight of the body were recommended with the result that the patient was able to walk after the lapse of another thirty-five days.

RICHARD KEMEL, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Seiro, V.: The Venous Pressure and Circulation in Varices of the Lower Extremities (Ueber Blutdruck und Blutkreislauf in den Krampfadern der unteren Extremitaeten). *Acta Soc. med. Fennicae Duodecim*, 1939, Ser. B., 27: Fasc. 1–2.

There are no satisfactory methods for measuring the absolute pressures in the superficial leg veins of standing persons, as the pressure varies with the level of the puncture site and with the height of the person. As the chief factor is the hydrostatic one, the best method of obtaining comparable results in different persons is to project the manometric determination upward on the anterior surface of the body and read it in relation to the various anatomical landmarks such as the umbilicus and xiphoid process. If this procedure is followed, the pressure values in varices of different types and in normal veins will be found to present no very great differences.

Pressure fluctuations may be brought about by various physiological activities such as intra-abdominal pressure, respirations, and muscular activity in the lower extremities. The latter is of great practical importance and may be studied in the standing subject with the venous manometer *in situ* by having him alternately contract and relax his muscles as though he were walking. This experiment will divide the subjects into two groups, those in whom the manometric decline is slight and those in whom it is great during exercise. In the first group the reading may drop to the xiphoid process or epigastric region, while in the second group it may fall to the groin, upper thigh, or occasionally to the knee. If the great saphenous vein is compressed near the knee while the exercise is being continued, there will be very little change in the second group, but in the first group the levels will fall until they approximate those of the second group. If the compression is discontinued in the first group the pressure soon climbs to its former height.

These fundamental differences in pressure behavior in the two groups depend, obviously, upon whether the valves above the compressed area are competent or not. Although the muscle contractions affect the venous flow only by compression of the deep veins, the pressure changes in the latter are reflected in the superficial veins, because of the communicating veins between them.

It was noted that when two manometers were placed in the same varicose vein, one in the leg and one in the thigh, exercise brought a greater pressure decrease in the lower than in the upper one. This difference usually amounted to only about 2 cm., but on one occasion it was between 6 and 7 cm.

Noteworthy pressure differences exist in the varices of the thigh and leg if one compresses the great saphenous at various levels during exercise. If the valves are incompetent and the compression is at the level of the knee, the pressure in the lower one sinks, but the upper remains constant or even increases. If the compression is near the fossa ovalis, however, the pressures decrease a nearly equal amount, although the leg pressure always remains slightly lower than that of the thigh. If simultaneous compression is made in the two areas, the leg pressure falls about as before, but the pressure in the thigh vein does not decrease as much.

The manner of the pressure descent in the manometer is very variable. In the case of a normal vein, or a varix in which the valves are competent, the meniscus drops quickly and smoothly with exercise. One notes that the meniscus drops each time the muscles slacken, and that it either remains on the same level or climbs a little during each contraction. However, if the valves are incompetent, the fall is quite slow while the amplitude of the excursions is increased. If, while the pressure is falling after compression of the great saphenous, excursions of great amplitude (from 20 to 30 cm.) occur, it is evident that during muscle contraction blood is flowing out of the deep veins into the superficial veins. This is an indication that the communicating veins are functionally insufficient. FRANK MCDOWELL, M.D.

BLOOD; TRANSFUSION

Buerkle-de la Camp, H.: Blood Transfusion in War, with Particular Regard to the Use of Preserved Blood (Ueber die Bluttransfusion im Kriegsfall unter besonderer Beruecksichtigung der Verwendung konservierten Blutes). *Deutsche Ztschr. f. Chir.*, 1939, 252: 365.

In 1866 3 unsuccessful blood transfusions were made; in the American Civil War 3, in 1870–71, and shortly thereafter, 37 successful ones. In the World War transfusion was carried out on the German side in only a few cases; by the French in 1917–18 in 114 cases with success in from 27 to 62 per cent and death from hemolysis in 5 per cent. The English and Americans performed a considerable number of transfusions and even at that time were using blood preserved with sodium citrate.

There are in reality six blood groups: A, A_1, A_2, AB, B, and O. O can easily be mistaken for A_2. This mistake can be avoided by use of the test serum O. The M.N.S. factors play a rôle only in medical jurisprudence and are of no practical importance in relation to blood transfusion. Our earlier ignorance of the titer content of blood serums was a not infrequent source of error, for the titer differed widely with different firms. For the last year and a half, however, the titer of serums has been officially tested in Germany. The author recommends repeated testing for the group with three test serums, better still with the crossed pre-

liminary test, which he has found particularly valuable. After brief centrifugation the blood corpuscles of the donor are tested in the serum of the recipient. The blood group determination should be basically macroscopic, since the nummular formation of the erythrocytes can easily be falsely interpreted on microscopic examination. The test serum should be mixed with the drop of blood diluted 1 : 1 with physiological solution of sodium chloride. Oehl's biological preliminary test, however, is and remains the best. In this test from 5 to 10 c.cm. of the donor's blood are injected slowly, after which the operator waits two minutes to see whether any undesirable symptoms appear in the recipient. If no such symptoms develop, he injects from 30 to 50 c.cm. and waits another two minutes. If this amount is well borne, there is no danger. If it can possibly be obtained, blood of the recipient's own group should be used. One should not rely on the O donor, especially in the case of exsanguinated or cachectic patients. If the blood is not well borne, Hesse advises the immediate injection of large quantities of blood of the same group as that of the patient, but 20 c.cm. of blood of a different group is tolerated if the transfusion is broken off at once. The author does not share the disinclination which many feel toward using the same donor repeatedly for the same patient. The injected blood acts chiefly through the oxygen-carrying function of its red corpuscles. These remain alive for from twenty to thirty days and have even been demonstrated after as long as from eighty-five to one hundred and thirteen days. At the same time the foreign protein in the blood serum acts as a strong irritant to the cell protoplasm. Infusion fluids or serums can never take the place of blood transfusion. One should not, however, give more than from 500 to 600 c.cm. of blood for fear of putting too great a load on the weakened heart.

Blood transfusion cannot be surpassed as a remedy for shock or as a means of controlling hemorrhage from an organ. The author has seen good results from transfusion in infections, poisoning, and severe burns, but in these cases it must be done early, while the body still possesses some power of resistance—in burns on the third or fourth day, if there is evidence of inspissation of the blood, when from 400 to 500 c.cm. may be injected once or twice daily after a preliminary venesection.

He distinguishes between blood in its natural state and preserved blood, the latter having substances added to it to prevent coagulation and enhance its keeping qualities. Natural, unchanged blood can be given only in hospitals; preserved blood can be given in the chief dressing stations at the front. Sodium citrate in too large quantities can have harmful results, but in the usual concentrations it is perfectly safe. The rigors which have been frequently observed after its use can be prevented by keeping the apparatus scrupulously clean and using water which has been distilled three times. With 500 c.cm. of blood 5 c.cm. of a 30 per cent solution of sodium citrate are used (Hesse). Care must be taken that the donor's blood does not run down along the sides of the vessel into which it is withdrawn but falls directly into the citrate solution. It is also necessary that the sterilized vessel be covered while the blood is running in, so that no air becomes mixed with it. If it is desired to keep the blood for a considerable time, it must be kept in the dark and at a temperature between $-2°$ and $+4°$ C. Hemolysis can be latent. The heating of the preserved blood before the transfusion must be done slowly and the blood must not be brought to a higher temperature than 40° C.

Cadaver blood has been injected successfully in Russia; but the author agrees with Franz that its use goes against our sensibilities. Furthermore, there are many precautionary measures that must be observed in the obtaining of such blood. The Japanese Riguchi recommends also dried blood, but this no longer contains any red corpuscles. According to Kaefer, the Japanese have used ascites fluid for transfusion with success in the war. The author has had no experience with Vital Serum, for which the rectal route is used.

For long keeping, blood may be treated with any one of the following: (1) sodium citrate 5.0, sodium chloride 9.0, double distilled water to 1,000c. cm.; (2) tribasic sodium citrate 5.2, sodium chloride 7.0, potassium chloride 0.2, anhydrous magnesium sulfate 0.04, double distilled water to 1,000 c.cm.; or (3) sodium citrate 5.0, glucose 40.0, double distilled water to 1,000 c.cm. Whichever of these three solutions is used, the same quantity of the solution is mixed with a given quantity of blood. In the Spanish War similar glucose-citrate solutions were used with success. On the average one may reckon on from ten to fourteen days as the length of time that blood so treated will keep.

From Russian sources Franz has drawn the following criteria to be applied in the macroscopic testing for hemolysis: (1) sharp line of division between the globular mass and the plasma; (2) no serum coagulation or flecks in the fluid layer; (3) the plasma must not be of a distinctly red color, neither should it show even a narrow layer of rose color.

For Germany the author recommends preserved blood for the sanitary formations near the front. Uniform containers must be provided for transportation. There must be no air above the blood in the container, as hemolysis would be produced by shaking. The "Thrombophob" and the "Autoinjectable Rapid" may be considered. The blood must be obtained from the native country from women and be transported in a refrigerator by special conveyance. Although in the Spanish War Group-O donors were used by preference, one Group A blood should be kept at hand, for patients transfused at the front will be mostly the severely wounded and exsanguinated and for these Group-O blood may be harmful.

(Franz). Florence A. Carpenter.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Borsato, E.: The Urinary Sulfur in the Postoperative Period (Comportamento dello solfo urinario nel periodo post-operatorio). *Arch. ital. di chir.*, 1939, 57: 111.

In a previous publication the author demonstrated that the blood sulfur reached its maximum on the second or third day after operation and that the increase was due to disintegration of protein substances at the site of surgical trauma. Larizza has shown that nitrogen retention is associated with sulfur retention, so that renal function is important in both. Some authors have even at times demonstrated a sulfur retention before the increase in blood nitrogen became manifest.

For these reasons the author made a series of studies on the elimination of sulfur in the urine during the postoperative period and made a comparison with other substances eliminated in the urine. He notes that urinary sulfur is excreted in the form of sulfates, ethereal sulfates, and neutral sulfates. Since a minimal part of the urinary sulfates comes from the sulfur assimilated through the gastro-intestinal tract, and the larger portion comes from the destruction of tissue proteins, the urinary sulfur constitutes an index of protein metabolism. The acid sulfates result from the destruction of the amino-acids and represent a detoxicating function of the body. The conjugated sulfates or ethereal sulfates result from detoxicating functions of the liver, to which organ the indole and skatole formed in intestinal putrefaction are brought by the portal system and are transformed into the harmless conjugated sulfates. The various metals, such as calcium, magnesium, and mercury, occur as sulfates. A normal adult eliminates from 1.5 to 2 gm. of sulfur per day. The author has demonstrated that the acid sulfur is directly related to the alimentary proteins.

Urinary sulfur has been studied in various conditions. In chronic diseases the elimination of urinary sulfur is diminished. In acute febrile diseases the urinary sulfur is increased in proportion to the elimination of nitrogen. This permits the exact estimation of the degree of organic disintegration. The author cites the literature on sulfur elimination in various clinical conditions. He mentions the more recent experiments of Gosset and Delauney, who found that after muscular trauma in dogs the urinary sulfur gradually increased for three or four days, remained high from the fifth to the seventh day, then rapidly diminished.

The author studied the urinary elimination of sulfur in 15 patients during the postoperative period after gastric resection, and after operations for chronic appendicitis, and hernia. There was no correlation found between the temperature curve and the curve of sulfur elimination, nor was the type of anesthesia found to influence the sulfur output. The extent of operative trauma was not found to be correlated with the urinary sulfur elimination. Each organism responds according to its own metabolic state. Likewise, age bore no relation to sulfur excretion in the urine. The quality and quantity of food administered, however, did have an effect on the sulfur output; also the quantity of water administered affected the sulfur output—in the days immediately following operation there was a relative renal insufficiency because of restricted water intake. In two-thirds of the cases there was an increased urinary sulfur output during the first twenty-four hours because of increased endogenous protein metabolism caused by the surgical trauma. It was found that there is a relative renal insufficiency early in the postoperative period. On the second postoperative day there is an increased elimination of sulfur due to endogenous protein metabolism. The increase in elimination of conjugated sulfates in the early postoperative period is due to intestinal putrefaction. The accumulation of these phenol bodies in the blood may cause headache, nausea, and malaise. These symptoms disappear with the administration of cathartics and the restoration of bowel motility. These studies add to our knowledge of the humoral and urinary changes occurring in the postoperative period.

JACOB E. KLEIN, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Wilson, W. C., and Stewart, C. P.: Changes in the Blood Chemistry after Burning Injuries and in Other Grave Surgical Conditions; with Some Reference to Treatment with Desoxycorticosterone Acetate. *Edinburgh M. J.*, 1939, 46: 153.

In previous articles the authors have noted the effect of suprarenal cortical extract during the stage of acute toxemia of burns, and they have noted that following such injuries a considerable fall of the serum sodium occurred. The present report is based upon their studies of the blood changes associated with circulatory failure, and the action of the synthetic hormone, desoxycorticosterone acetate.

Forty-one patients with burns were studied. Following preliminary cleansing, the burns were treated with 10 per cent Ag. No. 1 and 1 per cent gentian violet. There were 4 deaths.

Detailed histories of representative burns and of the blood chemistry changes are given.

The sodium level of blood serum and of other extracellular fluids frequently falls following burning injuries. This fall occurs after burns of moderate degree as well as after extensive ones. The change begins within one or two hours, but is at its maximum after from six to fifty hours. During the first

few hours there is no exact correlation between the extent of burned surface and the serum-sodium level, but later the lowest levels are found in extensive burns. The fall of serum sodium is accompanied by other changes which are characteristic, such as a rise of the serum potassium of the blood, the serum non-protein nitrogen, the urea nitrogen, and the blood chlorides, and a fall of serum chlorides. Hemoglobin concentration is frequent though inconstant.

In animals it appears that the sodium is not lost in the urine, nor is it lost because of any inhibition of activity of the suprarenal cortex; probably it is lost into the cells of the injured tissues. This theory of the mechanism of sodium loss holds true for the first few hours only, and it is possible that a different mechanism may be effective at a later stage.

The action of desoxycorticosterone acetate in correcting blood changes following burn injuries, particularly in restoring the serum sodium, is remarkably prompt and complete. Evidently desoxycorticosterone acetate mobilizes sodium from some store at present undecided. The evidence definitely forbids the assumption that the circulatory failure in secondary shock is due to a low level of serum sodium, or to any other blood change. There is no doubt but that desoxycorticosterone acetate has some beneficial action on the circulatory failure in cases of shock, provided that the failure is not profound. In very advanced shock, desoxycorticosterone acetate by itself is without effect. Probably it should be regarded as an adjuvant measure in the treatment of shock, and used in conjunction with the restoration of the blood volume.

The value of this synthetic hormone in other surgical conditions associated with grave circulatory disturbance has not been constant, although occasional beneficial action has been shown. It has no obvious effect on bacterial infections.

HARVEY S. ALLEN, M.D.

Gold, H.: Active Immunization Against Tetanus. *Ann. Int. Med.*, 1939, 13: 768.

Active immunization against tetanus has aroused a great deal of interest because of its possible use as a preventive measure of general applicability. The antitoxin titer produced by the injection of tetanus toxoid, and the influence exerted upon this titer by such factors as dosage, the time interval between injections, associated antigens, and "repeat" or stimulating injections of toxoid, have been the subject of careful investigation.

The injection of tetanus toxoid produces in most individuals a slight to moderate local reaction that lasts from one to three days. No systemic reactions were encountered. Alum-precipitated toxoid tends to produce a subcutaneous nodule at the site of injection similar to that produced by diptheria alum toxoid. It is usually absorbed in from two to four weeks.

Within the limitations of the schedule (dose and time interval) used, 2 doses of alum-precipitated toxoid were found to produce a higher level of antitoxic immunity than 3 injections of plain toxoid or plain toxoid plus 0.4 per cent alum. The loss of antitoxin in all groups, regardless of the type of antigen used, was most marked in the few months following the basic course of immunization, so that by the end of from nine months to a year, the great majority of the immunized individuals showed less than the minimum protective level of 0.1 unit of antitoxin per c.cm. of blood serum. Although the amount of antitoxin produced and lost varies in different individuals and is actually unpredictable, and the loss in titers is not directly proportionate to the amount of antitoxin previously present in the blood, there is a definite tendency on the part of those subjects that develop the highest values of antitoxin to retain a protective titer for a longer period of time.

The first dose of alum-precipitated toxoid affects the antitoxin-producing cells of the body in such a manner that following a second injection there is a rather prompt increase in the antitoxin content of the blood. A certain period of time must elapse between these 2 injections before this release of antitoxin into the blood stream takes place. It may be as short as six weeks, and as long as five years and perhaps longer. The effect of the first dose of alum toxoid is rather unique in that it cannot be replaced by the natural occurrence of tetanus and recovery from it. Following the second dose, a few days elapse before a protective titer develops. Hence, if an injury occurs during the interval between the 2 injections of alum toxoid and for a week or two following the second injection, passive immunization may be necessary in order to get full protection against tetanus.

The variability in the antitoxin response of different individuals following the primary series of injections, irrespective of the antigen used, makes it necessary to administer a "repeat" or stimulating dose of toxoid whenever an injury occurs. Although the series of reported cases given a "repeat" dose of plain toxoid is small, there is a possibility that this plain antigen may be able to bring up the antitoxic content of the blood to the 0.1 unit level more quickly than is the case with the alum-precipitated toxoid.

The "repeat" or stimulating dose of plain or alum-precipitated toxoid produces within one week a remarkable increase in the antitoxin content of the blood. In most cases, about five days elapse after the injection of the "repeat" dose before the antitoxin titer is brought up to or above the protective level. It is stated that the period of incubation of tetanus in man is usually from six to fourteen days and is directly proportional to the amount of toxin and the severity of the disease. With a short period of incubation, six days or less, the disease is almost always fatal. Whether the mobilization of antitoxin that occurs after the injection of the "repeat" dose is fast enough to prevent all cases of acute tetanus is not definitely known.

Between the first and third month after the "repeat" injection there is a sharp drop in antitoxin titer. Thereafter the loss is more gradual. Notwithstanding this, all subjects had a good protective

titer when tested sixteen months after the "repeat" dose. This is in marked contrast to the rapid antitoxin loss which these same subjects experienced after the primary course of injections, and would indicate that there is a greater permanency in the protective titer that develops after the injection of the stimulating dose.

It appears, therefore, that active immunization against tetanus by means of the injection of 2 doses of alum-precipitated toxoid, followed by a "repeat" injection upon the occurrence of an injury, will prove to be of value in military practice, in civil life where frequent injuries make the repeated injection of tetanus antitoxin impossible, and in the handling of allergic individuals who are sensitive to horse serum.

SAMUEL KAHN, M.D.

Schroeder, A. H., and Ramírez, F.: Two Cases of Cerebral Echinococcus Cyst Associated with Infantilism (Dos casos de quiste hidático cerebral con infantilismo). *An. Fac. de med., Univ. de Montevideo*, 1939, 24: 649.

Among the cases of cerebral echinococcus cyst observed by the authors at the Institute of Neurology, 2 were associated with infantilism, and it was believed that the pathogenesis of this peculiarity was linked with the development of the cerebral tumor.

The first case was that of a Uruguayan boy fifteen years of age, who came to the clinic complaining of cephalalgia which occurred every morning. He was unable to indicate the precise localization of the pain, though he frequently pointed to the left frontal region. There was occasional vomiting in the morning. His physical development was that of an eight-year-old child, although the skeletal proportions were not abnormal. The fingers were short and thick; the palm of the hand was also short and wide. There was an absence of the secondary sex characteristics, no pubic or axillary hair. The genital organs were underdeveloped. The Casoni reaction was negative. A roentgenogram of the cranium showed disjunction of the sutures and enlargement of the sella turcica which was also open.

The skeletal development corresponded with that of a child eight years old. The only neurological symptom being a right facial paresis, the right cerebral ventricle was examined. Forty cubic centimeters of liquid were removed and air was substituted with great difficulty, since the latter escaped immediately after its injection. Roentgenograms (Fig. 1) showed a displacement of the right ventricle, which appeared compressed by a neoplasm, situated, as supposed, in the left frontal region. The possibility of a hydatid cyst being apparent, trepanation was performed over the frontal lobe I. Puncture immediately produced a liquid which was replaced by air. Exploration of the frontal region, Roland's area, and of the left temporal lobe followed. The dura mater was opened and revealed an edematous condition of the brain. Puncture of the posterior temporal lobe produced 140 c.cm. of turbid liquid.

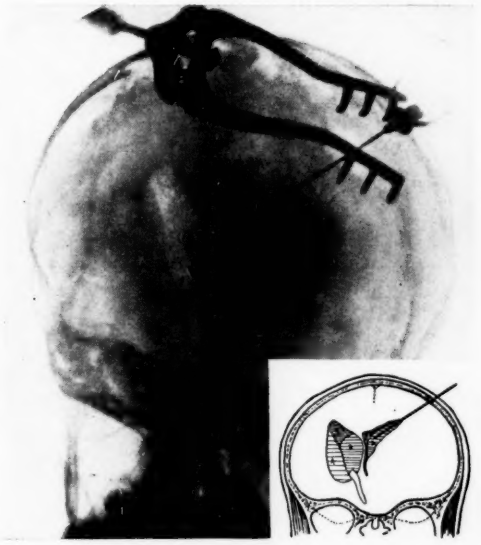

Fig. 1

A renewed injection of air revealed a shadow which extended to the occipitotemporoparietal regions. An opening of 4 cm. in depth made at the site of the puncture disclosed a cystic membrane which was removed with the aspirator. With the extraction of the membrane the entire posterior occipitotemporoparietal regions collapsed, showing that the cyst had occupied these regions. The cavity was swabbed with physiological serum and the opening sutured without drainage. After an attack of aphasia and light hemiplegia, the patient recovered. He returned to the clinic, however, some time later with a number of cysts in the cavity, to which he succumbed.

The second case was that of an Uruguayan boy fourteen years old who had suffered for the past eight months from a slowly progressive left hemiplegia, frequent frontal cephalalgia, and vomiting. Examination revealed his physical development to be far behind his age. There was absence of pubic and axillary hair; the genital organs showed infantile development; and there was nystagmus. Percussion of the right frontoparietotemporal region was painful.

After local anesthesia the left frontal region was opened in order to reach the left lateral ventricle, but nothing of importance was found. Upon examination of the dura mater, however, an enormous cyst was discovered which occupied the temporoparietal region, part of the frontal, and all of the occipital region. The membrane was removed and the operation followed up with a lavage with ether.

The postoperative condition included severe headache, hyperthermia, and a meningeal syndrome. The patient died five days after the operation. Autopsy revealed a purulent exudate predominating in the

Fig. 2

right cerebral hemisphere. A cavity as large as a medium-sized fetal head was found; it was lined with a thin purulent membrane (Fig. 2). The left lateral ventricle was dilated and also lined with a thin purulent membrane.

In both cases the good general physical condition of the patients was striking. The marked neurological disturbances pointed to echinococcus cyst of the brain. The conjunction of symptoms observed was characteristic: (1) both patients lived in a rural community; (2) there was a marked hypertensive syndrome in both; (3) there were few symptoms of localization, and (4) the general condition was excellent.

The authors point out that it is no rare occurrence to find few or no symptoms which would lead to definite localization of the cyst. Slight facial paresis, difference in reflex, uncertain gait, and, in one of the cases, hemiplegia and nystagmus were present. Patients with hydatid cyst of the brain do not present the aspect of pain and depression which is usually associated with cerebral tumor. They are well nourished and of contented disposition. This bears out the opinion that the hydatid cyst is of little toxicity to the brain, which permits the cyst to reach an enormous size and manifest symptoms—like infantilism—which require much time to become evident. In the cases described, the Casoni and Weinberg tests were negative.

Infantilism was the most striking particular symptom in both cases. The general aspect presented was physical underdevelopment. The stature was small but well proportioned. The facial expression was markedly childish; the eyes small, the nose broad, and depressed at the base. The hands were small, broad, with short thick fingers. There was no cyanosis. The characteristics of the feet were similar to those of the hands, but less pronounced. The subcutaneous cellular tissue presented no abnormal distribution nor infiltration of any kind, though there was a slight tendency toward accumulation in the region of the abdomen, thigh, and hip.

The first case presented a basal metabolism lowered to -25, a condition usually encountered in endocrine hypofunction. The second case, however, showed increased metabolism ($+15$).

The curve after adrenalin injection for testing glycemia showed that there was a rapid increase, followed by an equally rapid decrease, the final level being lower than the initial one. This rapid rise of hyperglycemia with subnormal decrease is considered a sufficient characteristic of hypopituitarism and hypothyroidism.

Upon the basis of their studies the authors have diagnosed the cases as hypophyseal infantilism, without referring in any way to the Froehlich syndrome, which is much more complicated in its symptoms and pathogenesis and which, as a rule, is not associated with infantilism. The authors firmly believe that there exists a close causative relation between cerebral echinococcus cyst, infantilism, and hypertension.

Summarizing the most striking observations of the two cases, the authors quote: (1) infantilism; (2) the destroyed sellæ turcicæ; and (3) the hypophysis which apparently was also destroyed, though not anatomically, but at least from the point of view of function through the extraordinary pressure suffered from hypertension. It is assumed therefore that a severe anatomical and functional inhibition of the hypophysis may provoke, during early childhood, profound morphological and genital alterations.

HILDA H. WULLEN.

Meleney, F. L., and Harvey, H. D.: The Combined Use of Zinc Peroxide and Sulfanilamide in the Treatment of Chronic, Undermining, Burrowing Ulcers Due to the Micro-Aerophilic Hemolytic Streptococcus. *Ann. Surg.*, 1939, 110: 1067.

Chronic, undermining, burrowing ulcers may follow operations, lymph-node involvement, secondary contamination of an accidental wound, or a previously existing infection. Meleney and his coworkers are convinced that the organism in these ulcerating lesions is a micro-aerophilic hemolytic streptococcus. These organisms prefer for their multiplication an environment having a reduced oxidation-reduction potential. The authors point out that these ulcers are always contaminated with many different species of bacteria, and only by careful anaerobic bacteriological studies can the true etiological organism be

identified. In a series of over 40 cases the microaerophilic hemolytic streptococcus was invariably found. In many instances this organism was found in pure culture when the material to be cultured was taken from the depths of the lesion. It is concluded that lack of proper bacteriological facilities has often prevented the recognition of this causative agent.

The authors and others have had gratifying success in the treatment of these burrowing ulcers with zinc peroxide alone. Treatment by this method has the disadvantage of frequently requiring a preliminary operation in order to expose the involved tissues to the local application of zinc peroxide. In view of the striking results obtained with sulfanilamide in the treatment of certain other types of streptococcic infection, an attempt was made to evaluate the results of sulfanilamide therapy in this condition. Observations were made on 19 cases. In 8 of the 19 cases, sulfanilamide was used in conjunction with zinc peroxide; in 8 other cases sulfanilamide was employed before zinc peroxide; in 1 case sulfanilamide was used alone; and in the 2 remaining cases sulfanilamide was used after treatment with zinc peroxide had begun. Sulfanilamide seemed to be of some value in 5 of the 19 cases treated, and in 2 other cases the drug was of questionable benefit. In the 12 other cases no beneficial effects whatsoever could be detected. The best results in this series of cases seemed to be obtained when zinc peroxide and sulfanilamide were used simultaneously. Healing was obtained after a long interval in the single case in which sulfanilamide was used alone, but the authors point out that cases treated with zinc peroxide alone or with a combination of the two forms of therapy have a much shorter and more satisfactory period of recovery.

A detailed description of the technique of treatment is given. After the diagnosis has been confirmed by bacteriological studies, zinc peroxide should be applied locally every day for one week. The authors point out that zinc peroxide manufactured by the Du Pont Chemical Company should be used, as it is the only effective material available. They further point out that the peroxide must be closely applied to all affected areas, and that the dressing must be kept moist to be effective. Sulfanilamide should be administered in doses of 1.2 gm. from every four to six hours unless toxic symptoms supervene. If, after a week of the above therapy, the process still seems to be active, wide surgical excision of the margins and exposure of deep sinuses must be undertaken. Treatment with zinc peroxide should then be continued until the surface is covered with healthy granulations, at which time skin grafts may be applied.

LUTHER H. WOLFF, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Frimann-Dahl, J.: Roentgenological Examination of Acute Abdominal Lesions. *Acta radiol.*, 1939, 20: 438.

The literature relating to roentgenological examinations of acute abdominal lesions is reviewed briefly, with special reference to contributions from the Scandinavian countries. A short résumé of the roentgen anatomy of the abdomen insofar as it has a bearing on findings in such lesions is also included. Most of the paper is devoted to a review of 488 cases under observation within the last three years, comprising perforated ulcers, ileus, volvulus of the large intestine, ureteral stones, and traumatic renal lesions. The technique used in connection with them is described.

As regards perforated ulcers, 9 of the 41 cases examined yielded negative findings. Among the positive findings, in addition to spontaneous pneumothorax, demonstration of a fluid level without certain air, and demonstration of the ulcer niche directly from gastric air within it are mentioned. Although the use of a barium contrast meal usually is contraindicated the author is inclined to favor the giving of one or two mouthfuls of it in exceptional cases to help in the differential diagnosis.

In all cases of clinically established mechanical ileus except one, the roentgen examination revealed distended intestines with horizontal fluid levels. In approximately half of the cases of obstruction of the small intestine, no air could be demonstrated in the large intestine. In 20 per cent enough was present to outline it, and the remaining 30 per cent showed only small amounts. Often it is not possible to distinguish with certainty the mechanical ileus from the paralytic, as the bowel, even if a true mechanical ileus is present, may be in a very quiet phase with small, hardly visible or audible movements. In other cases the movement or lack of movement of the fluid levels, their shape and extension, as also signs of peritonitis, may allow a specific roentgenological diagnosis. As a rule, obstruction of the large bowel is fairly easily recognized from the gas distention in it. This need not necessarily appear just proximal to the stenosis. A distention of small gut even with fluid levels may occur secondary to an insufficiency of the ileocecal valve. The location of the obstruction can be more exactly demonstrated with the opaque enema. Volvulus of the colon gives a typical and generally easily interpreted roentgenological finding. It is diagnosed on survey exposures made in different recumbent postures, with or without barium enemas.

Although ureteral stones with acute symptoms do not belong among abdominal lesions, they very frequently enter into the differential diagnosis of such lesions and are therefore given consideration. Attention is called to the value of immediate intravenous urography when there is doubt as to whether ureteral stones may be the cause of the symptoms present. In acute abdominal traumatisms, the diagnosis of renal trauma is greatly facilitated by such an examination, in addition to the information plain survey films may yield. ADOLPH HARTUNG, M.D.

Fig. 1. Mechanical ileus of the small intestine in standing posture. Large, garland-shaped coils, mostly in the upper part of the abdomen. In some smaller coils the fluid reaches different heights in the two segments.

Weintraub, S., and Snow, W.: Roentgenological Visualization of the Soft Structures of Pregnancy: Experimental Evidence. *Am. J. Roentgenol.*, 1939, 42: 718.

On the roentgenogram of advanced pregnancy there can be seen a black delineation between the fetus and the placenta. Proof of the nature of the structure that causes this black shadow is herewith submitted.

A roentgenogram was made of a stillborn fetus while it was in an aluminum container filled with water. Not only was the vernix removed from this specimen, but large areas of superficial skin were also peeled away. Despite this, the same linear black shadows were produced on the film, which showed that the shadow could not be caused by vernix.

Next, a longitudinal section of one of the lower extremities was made. A roentgen examination of this prepared specimen showed three degrees of density on the film (Fig. 1). There was the bony type, which is obvious; surrounding this was a gray type which conformed to the muscles, and surrounding this was a black type which conformed to the subcutaneous fat.

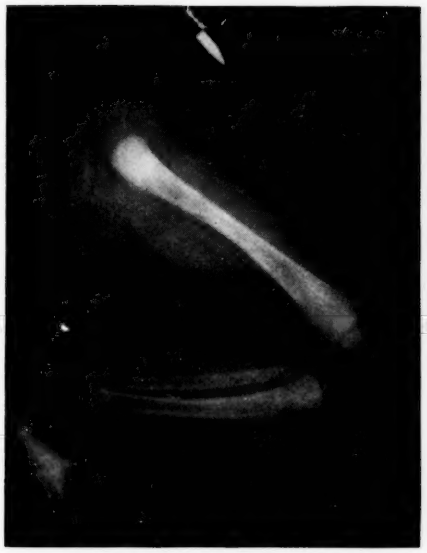

Fig. 1. Roentgenogram of specimen with ball of vernix caseosa next to it. The density of the latter is more that of muscle than that of fat.

A quantity of vernix caseosa was rolled into a ball about 1.5 cm. in diameter. This was placed next to the prepared longitudinal section of the lower extremity and both were simultaneously roentgenographed. The density of this body was approximately that of muscle and decidedly not that of fat, as is shown on the film. DANIEL G. MORTON, M.D.

Bromer, R. S.: Significant Skeletal Changes in Low Back and Sciatic Pain: Roentgenological Observations. *Radiology*, 1939, 33: 688.

In this paper, the literature has been reviewed and the skeletal changes associated with low back and sciatic pain have been listed with an attempt to evaluate the rôle played by them. The following congenital variations for which no causal relationship to such pain has been proved are encountered frequently:

(1) Slightly bifid posterior spinous process of the fifth lumbar vertebra or the upper sacral segment.
(2) Lumbarization of the fifth lumbar vertebra, unilateral or bilateral.
(3) Sacralization of the fifth lumbar vertebra, unilateral or bilateral.
(4) Exaggerated or decreased lumbar lordosis.
(5) Scoliosis of the lumbar vertebræ, usually of mild degree, with or without actual rotation of the bodies of the vertebræ.
(6) Elongated transverse processes, often occurring with partial sacralization.
(7) "Butterfly" type of transverse process, fifth lumbar vertebra.

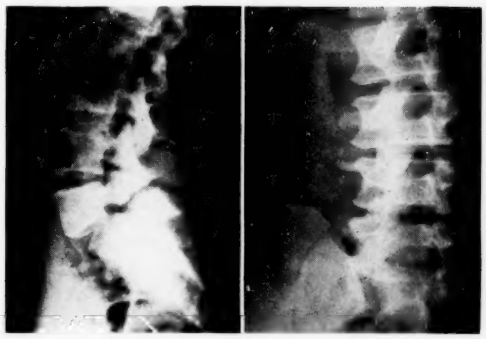

Fig. 1 Fig. 2

Fig. 1. Lateral projection. Pre-spondylolisthesis. The laminar defect is plainly visible.

Fig. 2. Changes in the articular facets: hypertrophic osteo-arthritis. Increased density of cortex of intervertebral facets, partial obliteration of interarticular spaces, second, third, and fourth lumbar vertebræ. Symptoms of low back pain with sciatic radiation.

(8) Impingement of the transverse processes of the fifth lumbar vertebra on the iliac crests.

The skeletal changes which appear to have a more or less justifiable relationship to low back and sciatica pain which are discussed in detail include:

(1) Defects in the neural arch.
(2) Changes in the articular facets.
(3) Accessory articular processes in the lumbar spine.
(4) The narrow lumbosacral joint space.
(5) Posterior luxations of the lumbosacral joint.
(6) Platyspondylia.

The nature of the findings, the significance attached to them by different authors, and their value in differential diagnosis are given extensive consideration.

In conclusion it is stated that the study of the various changes encountered emphasizes the fact that roentgenological examinations are mandatory in connection with low back and sciatic pain and rational therapy can be undertaken only after the most comprehensive clinical and roentgenological studies. ADOLPH HARTUNG, M.D.

Poppel, M. H.; Sympus Monopus. *Am. J. Roentgenol.*, 1939, 42: 721.

A sympus, sympodia, or symmelia is a monstrosity in which the lower limbs are fused to a greater or lesser degree and are more or less imperfectly developed, together with some defect in the bony pelvis.

The fusion of the lower limbs is a condition that can occur only in the absence or reduction of the structures which normally intervene between them; i.e., the caudal end of the vertebral column and the cloaca. Narrowing of the tail end, due to reduction of the vertebral column, is probably caused by a

Fig. 1. Sympus monopus.

deficiency in the vascular supply. Such a narrowing causes approximation of the lower limb buds with resultant monstrosity.

A case is reported. The figure shows the essential details.

The primary centers for the iliac and the pubic bones are normal. There are no primary centers visualized for the ischia.

The lower extremities are completely fused and are fixed at right angles in a forward direction to the long axis of the spine.

The proximal portion of the monopus, representing the fused thigh areas, contains one large long bone which shows evidence of having resulted from the fusion of the primary centers of each of the femora. It is normal in length and almost twice the thickness of the normal femur. There are no capital epiphyses present. There are two epiphyses present at the distal end, each representing the normal distal femoral epiphysis.

The portion of the monopus representing the fused legs contains two normal tibias with a normal single fibula placed between them.

At this point the distal portion of the monopus acutely folds upon itself in a dorsal direction for 180 degrees. This represents the fused feet and contains centers for two metatarsal and six phalangeal bones.

DANIEL G. MORTON, M.D.

Teall, C. G.: A Roentgenological Study of the Bone Changes in Hemolytic Anemia and Leukemia in Children. *Brit. J. Radiol.*, 1939, 12: 601.

Blood dyscrasias are discussed in a general way in an attempt to explain the bone changes demonstrable roentgenologically which might reasonably be expected to occur in connection with those conditions. In the hemolytic anemias there is a variable response in the bone marrow which depends on the severity and chronicity of the anemia, and the hyperplasia may manifest itself by fairly characteristic findings on the roentgenogram. In the acute types no bone changes are found. Subacute cases show evidence of osteoporosis, especially in the metaphysis, and thinning of the cortical bone. In cases classified as subchronic the changes become more pronounced and there is a more open trabeculation near the extremities. Cranial bones show thickening, which usually is most marked in the frontal region, and radial striations may be evident. The tables are usually intact and the thickening is confined to the diploë.

In the leucemias, demonstrable bone changes may be entirely absent or so slight that only careful search on roentgenograms with good detail will reveal them. The earliest changes are a streaky type of bone absorption of variable extent. Subsequently generalized osteoporosis may occur, sometimes to an extreme degree. Cortical absorption also takes place and periosteal elevation may result in a double contour of the shafts of the long bones. Rarely a narrow band of lessened density may appear in the metaphysis.

ADOLPH HARTUNG, M.D.

Mustakallio, S., and Laitinen, H.: Insertion Pains, Their Roentgen Diagnosis, and Their Roentgen Treatment (Ueber die Insertionsschmerzen, ihre Roentgendiagnostik, und—Behandlung). *Acta radiol.*, 1939, 20: 427.

The authors made an intensive study of rheumatism, deeming it to be indicated on account of its prevalence and social significance. Former theories that the intima of the heart and the serosa of the joints were the main localizations of rheumatic infections are no longer tenable. The pathologico-anatomical examination of Klinge proved that any mesenchymal tissue may harbor evidence of this infection. At the present time, the insertion pains are also being defined as belonging to the rheumatic group.

Vulliet, in 1909, described insertion pain he suffered personally, defining it as epicondylitis following violent exercise, to which he ascribed the cause. His description of the disease is classical, but his theory of its cause (trauma and overstraining) does not correspond with present findings as there are additional causative factors. Insertion pains in the periosteum and tendon-insertions immediately or remotely following trauma or extreme muscular strain in parts that had a previous tendency or lesion favoring the localization of such rheumatic infections are the accepted etiology at present.

The roentgen department of the Finnish Red Cross Hospital treated 43 cases of insertion pains from 1933 to 1938. During the same period they treated 200 cases of humeroscapular periarthritis of which the majority evidently belonged to the group of insertion pains.

The pains in their cases were localized in the:

Humeral epicondyle	21
Calcaneus	21
Crest of the ilium	2
Deltoid tuberosity of the humerus	1
Spinous processes of the vertebræ	1
Styloid processes of the radius	1

Men are affected more frequently than women obviously on account of their greater activity in labor and in sports. The ages involved were between thirty-two and forty-four. Strange as it may appear, more brain workers than laborers were the sufferers. The right side was infected nearly four times oftener than the left.

It is remarkable that insertion pains following a slight trauma cause long-continued suffering. This speaks against the Vulliet theory as to etiology. The trauma stated in any amnesis must be regarded as effecting the locus minoris resistentiæ, i.e., a pre-existing susceptibility or abnormality of the bones, joints, or tendons involved.

The roentgen examinations revealed pre-existing conditions such as minor atrophies of the insertion areas, uneven contours of bones, boney spurs near the tendon insertions, or isolated calcareous deposits near the insertion areas. The latter were termed "peritendinitis calcarea" by Sandstroem. In some cases both the insertion site of the bone and the insertion-end of the tendon are diseased. This is a true periosteotendinitis which, in chronic cases, can easily be demonstrated roentgenologically.

Treatment is a problem as all insertion pains stubbornly resist therapy. The usual rheumatism treatment is ineffectual. Absolute or relative rest with complete immobilization of the diseased joint lasting at least four weeks is the only conservative treatment advised. In the most severe cases the surgical removal of any spur or other abnormality from the epicondyle is recommended as the only successful treatment of epicondylitis.

In recent years roentgen therapy has gained in favor. The insertion pains are irradiated and exceedingly good results are attained according to the reports of these authors. Some authorities claim that failure of roentgen treatment in these cases indicates a faulty diagnosis. MATHIAS J. SEIFERT, M.D.

Friedman, M.: The Relation of Tissue Recovery and the Healing Process to the Periodicity of Radiation Effects. *Radiology*, 1939, 33: 633.

The study of the various phases of radiation effects was made in the course of routine treatment of neoplasms of the upper respiratory tract with protracted fractionated radiation. Complete epithelitis reaction curves are charted.

The destructive phase occupies approximately the first four weeks of treatment; the cellulicidal effects of this phase are somewhat constant in onset and ascent, whereas there are more marked individual variations in the phenomena of the healing phase. The first destructive phase which occupies approximately the first twenty-eight days of treatment is most important because the rays are more effective and the tumor more radiosensitive at that time than subsequently. If the daily dose is large enough to produce severe reactions these reactions tend to be constant in character. If a daily skin dose of 200 roentgens is cut in half and the treatment correspondingly protracted, reactions are observed which recur cyclically, and to this phenomenon of cyclic recurrence of reactions the author applies the term periodicity.

Daily fractionated doses of x-ray are cumulative in their effect and the reactions become progressively more intense. However, each cellulicidal increment evokes a simultaneous healing effect which also appears to be cumulative. The daily healing increment is slower in onset and rate than the destructive process, but finally overwhelms the destructive effect and initiates a healing phase through which period reactions heal despite the fact that treatments are still being given.

The destructive phase is dependent upon (1) the quality of radiation (shorter wave length x-rays producing less intense reactions); (2) the size of the dose (reactions being mild and healing early when the daily dose is small); (3) the individual susceptibility; (4) the daily exposure, time and dosage rate (but protracted fractionated doses have so overwhelming a destructive effect as to counteract delicate differences); and (5) the continuity of treatment.

The healing phase begins between the thirty-fifth and forty-second days of treatment and lasts about four weeks. It is of much greater consequence than the destructive phase in the behavior of the tumor; its limits are more difficult to define. It is controlled by healing processes in the tissues and is also dependent upon the same factors which govern the destructive phase. During the healing phase, residual tumor cells have usually been matured by irradiation and have adapted themselves to radiation effects. The author recommends that during a prolonged course of treatment no treatment be given during the healing phase.

HAROLD C. OCHSNER, M.D.

Engelstad, R. B.: Radiological Treatment of Carcinoma of the Esophagus. *Acta radiol.*, 1939, 20: 469.

This article deals with a group of 119 cases of carcinoma of the esophagus which were treated at the Norwegian Radium Hospital from 1932 to 1938, inclusive. After a brief consideration of the various clinical phases, the author discusses the radiotherapeutic aspect rather extensively, paying much attention to technical details.

The average age of the entire group of patients was sixty-two years, with three-fourths of them being

between fifty and sixty-nine years, the youngest thirty-nine years, and the oldest eighty years.

As possible causative factors, concentrated alcohols in the male and the Plummer-Vinson syndrome in the female may have some significance.

A tabulation of the final results revealed that not one single case of permanent cure was obtained. The immediate results were: 4 patients were symptom free, 21 greatly benefited, 38 benefited, 32 not benefited, and in 16 the condition rapidly became worse after the treatment. Ten patients were still alive when the article was written, 5 three months, 3 from four to six months, 1 eleven months, and 1 fourteen months after treatment. The average duration of life of those who died was five and one-tenth months after treatment and ten and nine tenths months after the onset of the first symptoms.

The following method of irradiation is preferred at the present time:

Whenever possible the radium is applied first; from 3 to 5 tubes of 10 mgm. each are placed within a sound which is then introduced and remains for five hours daily in the esophagus for a total of from five to seven days. The dose as a rule amounts to 30 Dominici units, corresponding to about 2,500 roentgens. After the completion of the radium treatment, a full course of fractionated, protracted roentgen therapy is given with 175 kv, 2 mm. of copper, and 4 mm. of aluminum. The lesion is cross-fired through two anterior and two posterior portals and the irradiation is carried out in rotating cycles, with daily doses of from 150 to 300 roentgens until a total dose of from 12,000 to 16,000 roentgens is given. From eight to ten weeks are required to complete the entire treatment, due care being taken that fibrosis of the lungs is not encouraged.

In 23 cases, gastrostomy was performed, but the procedure has proved of so little value, even for palliative purposes, that more recently it is resorted to only in exceptional cases.

TRAIAN LEUCUTIA, M.D.

Kaplan, I. I.: Irradiation with Small Doses in the Treatment of Functional Gynecological Conditions. *Am. J. Roentgenol.*, 1939, 42: 731.

The present study indicates the results in the treatment of 194 married women who suffered with persistent amenorrhea and sterility.

In 1926 Rubin reported successful results in the treatment of patients with amenorrhea and sterility with roentgen irradiation. In 1927 Seitz reported 118 successful results in 209 cases of amenorrhea treated in this manner. Recently Mazer and Spitz reported beneficial results in 50 per cent of the cases in their series treated for sterility.

The action of the roentgen rays is not quite understood, but several apparently plausible explanations may be noted.

At present we are inclined to attach prime importance to the pituitary gland as the factor controlling menstrual function. Does roentgen irradiation of the ovaries activate that "bleeding factor" of the anterior pituitary gland which then produces menstrual bleeding, as suggested by Wilson and Kurzrok? Does roentgen irradiation act mechanically, as in the case of polycystic ovaries which are relieved (Stein and Leventhal) by mechanical destruction of the cysts but not by endocrine therapy? In the author's series, 1 patient had cystic ovaries, as proved at operation. Sterility was relieved by roentgen therapy, perhaps by destruction of the cysts. Does it destroy the corpus luteum which suppresses menstruation, according to Corner, or does it stimulate the general normal interchange of hormones which produces normal pituitary, ovarian, and uterine function and thus allows for menstruation and subsequent pregnancy?

Whether roentgen irradiation directly affects the ovary, the uterus, or the pituitary gland, or is an indefinite endocrinological factor stimulant is debatable. None the less, the fact remains that it has been a definite factor in the successful treatment of the cases herein reported. In the author's opinion no other treatment so far devised, including organotherapy, has yielded as satisfactory or equally good results.

Treatment in all cases was limited to irradiation with high-voltage roentgen therapy administered in small doses to the ovaries. In many of the cases additional roentgen therapy was given to the pituitary gland and in a few instances to the thyroid gland.

The factors used were: 200 kv., 4 ma., with 0.5 mm. of copper plus 1 mm. of aluminum filter, with a target distance of from 30 to 40 cm. Treatment was directed through anterior and posterior right and left pelvic fields of from 9 by 12 cm. to from 12 by 15 cm. and to the pituitary area on the skin through a 6 by 8 cm. field. The dose given was from 75 to 150 roentgens (measured in air), per field, at weekly intervals, for three weeks. The anterior pelvis was treated the first week, the posterior the second week, and the anterior the third week. Occasionally a fourth treatment was given. The pituitary gland was treated at the same session as the anterior pelvis.

All cases received roentgen therapy to the pelvis and 104 cases received additional treatment to the pituitary gland. In 6 cases the thyroid gland also was treated.

Of the 194 cases treated, 159 were followed up and in 103 of these the menses were regulated, while in 56 there was no improvement. The oldest patient treated was forty-five years of age and the youngest nineteen. The results were most successful in the twenty-one to twenty-nine-year-group, and next most successful in the thirty to forty-five-year-group.

The amenorrhea suffered in the cases herewith reported extended for periods of from one month to fourteen years and the sterility from one to eighteen years.

In 33 cases previous pregnancies had occurred, and in 17 of these pregnancy with abortion or miscarriage had occurred.

Of the 103 patients whose menstruation was reestablished, 51 became pregnant. In 52 instances no pregnancy occurred. Of the 51 patients who conceived, 1 was in the course of her pregnancy at the time of writing.

In the private group there were 131 cases of married women, of which 117 were followed up. In 79 cases, or 60 per cent, the menses was restored; in 52 cases there was no improvement. Among the 79 successful cases, 44 women conceived, 17 more than once; 5 conceived but aborted, and of these 2 aborted twice. Thirty-eight women went to term and gave birth to 50 living children. One went to term and gave birth to an abnormal fetus. One woman had twin girls, both physically and mentally normal, and 9 women had more than one child. Reports from the parents have in no instance disclosed any abnormalities or physical deformities in these children.

In the clinic group there were 63 cases, 39 of which were followed up. In 24, or 61 per cent, of the 39 cases, the menses were restored; in 15 there was no improvement. Among the 24 successful cases 7 women conceived, 3 bore normal children, 1 woman had a stillbirth, 1 was pregnant at the time of writing, and 2 became pregnant and delivered but did not subsequently report to the clinic.

None of the patients treated was harmed in any way. However, roentgen therapy is frequently harmful to the unborn child when administered to a pregnant mother, the harm depending to a great extent on the age of the embryo and the amount of irradiation given.

Because of the successful results secured through irradiation in the large number of cases in our series, with subsequent follow-up of children born of irradiated mothers, we feel warranted in reiterating our previous conclusions that irradiation, when properly given, is harmful neither to the mother nor to the offspring, and has proved a valuable therapeutic procedure for the treatment of amenorrhea and the relief of sterility.

DANIEL G. MORTON, M.D.

Allen, F. M.: Local Asphyxia and Roentgen Irradiation of Transplantable Rat Tumors. *Am. J. Roentgenol.*, 1939, 42: 745.

It has been established that the tolerance of normal tissues of the rat's leg for roentgen rays (a) is much higher than that of human tissues, (b) is apparently much higher for soft than for hard rays, and (c) is reduced by the local asphyxia resulting from ligation. Established tumors in the legs are cured to a higher degree by a combination of irradiation and local asphyxia than by either of these measures alone. A point of theoretical interest is that asphyxia, which thus augments the effect of roentgen irradiation, influences tumors through a reaction in the normal tissues rather than by direct destruction of the tumor cells. The effects of combined irradiation and local asphyxia are indistinguishable, whether the two are applied simultaneously or in sequence. The effects of both asphyxia and irradiation are persistent to the extent that an influence is demonstrable when either treatment is administered several days in advance of the other. Attempts were made to improve the efficiency and selectivity of the treatment, and the following facts were noted: (a) fractionation of the roentgen-ray dosage appeared much less promising in rats than in man, presumably because of the far more rapid growth of the rat tumors; (b) intense venous congestion without arterial stasis increased the curative action of the roentgen rays; (c) combinations of local asphyxia, irradiation, and fever gave poor curative results in proportion to the high mortality; they were therefore abandoned. Combined ligation and irradiation yielded a significant number of cures of tumors of the spleen and testis, but not of the kidney. Therefore, although the curability of the same type of tumor may vary in different locations, it does not run parallel with the radiosensitiveness of the organ in which it is embedded.

In the author's general summary, no attempt was made to settle questions of detail, such as the optimum conditions for practical results, but the most important theoretical contribution appears to lie in the possibility of converting a radioresistant tumor into a radiosensitive one by means of a reaction excited in the surrounding tissues.

JOSEPH K. NARAT, M.D.

RADIUM

Nebesky, O.: Six Years of Radiation Therapy of Carcinoma of the Uterine Cervix (Sechs Jahre Strahlentherapie beim Carcinoma colli uteri). *Geburtsh. u. Frauenheilk.*, 1939, 1: 418.

The author reviews 350 cases of carcinoma of the uterine cervix which he examined and irradiated, and gives his personal conclusions. The technique of treatment remained the same throughout the entire series.

In the first irradiation never less than 2,400 mgm.-hrs. were given because one never knows even in the early cases how widespread the carcinoma may be in the deeper tissues. Two tubes, each containing 50 mgm. of radium, were usually implanted in the form of a cross, the vertical tube being placed in the cervix and the horizontal tube in front of the portio. A catgut suture was used to prevent them from slipping out. In large craters, the tubes were inserted parallel to one another. In adenocarcinoma of the cervix, and in corpus carcinoma, the first irradiation was increased to 3,000 mgm. hrs.

All 350 cases were followed up five years or longer, but the author has divided them into three series, according to the time having elapsed since treatment. The operability varied between 42.5 and 51.4 per cent. There was complete healing in 26 per cent of the entire group of cases. In the international Groups I and II there was healing in 39.8 per cent but in Groups III and IV there was healing in only 14.2 per cent. The percentage of cures became bet-

ter as the author's experience increased, Groups I and II yielding cures in 31.4 per cent of the cases in the oldest series, in 40 per cent in the middle series, and in 48.1 per cent in the last series. The proportion of absolute results increased even more with experience, being first 19.3 per cent, then 28.5 per cent, and, in the last series, 32.3 per cent.

Of the 350 cases, 13 were operated upon because of concomitant pregnancy or ovarian tumor, and a rectovaginal or vesicovaginal fistula developed in 0.8 per cent of the healed cases. The results were more unfavorable in adenocarcinoma than in squamous cancers. The primary mortality of the radiation treatment was 3.7 per cent. The fatalities from recurrence in Groups II and III were highest during the first year after treatment. From one-fourth to one-third of the fatalities occurred during the second year, and only a few occurred in the third, fourth, and fifth years after irradiation. The middle-aged patients, between forty and sixty years of age, have the best prognosis. In order to obtain better results with younger patients, the author now gives 3,000 mgm. hrs. at the first treatment.

(KIRCHHOFF). FRANK MCDOWELL, M.D.

Nørgaard, F.: The Development of Fibrosarcoma as a Result of the Intra-Articular Injection of Radium Chloride for Therapeutic Purposes. A New Form of Radium Poisoning in Human Beings. *Am. J. Cancer*, 1939, 37: 329.

The occurrence of occupational radium poisoning among watch-dial painters was studied in America since 1924, and up to 1931 a total of 18 deaths was reported, due mostly to necrosis of the jaw and anemia.

At about the same time protests were raised by the medical profession against the uncontrolled use of radium waters and salts. A fatal case of poisoning was described by Netter and Norris, and later Martland published his observations on 2 persons who developed necrosis of the jaw.

The author now reports a new form of radium damage: a fibrosarcoma which appeared at the site of injection of a small quantity of radium salt for therapeutic purposes. The condition was noted in a woman fifty-six years of age who, in September, 1938, presented herself at the Radium Station of Copenhagen with a tumor of the right knee joint. Since childhood she had been suffering from arthritis of the left wrist and elbow, which at the age of thirty spread to the right knee, and at the age of forty-four to the right shoulder. In 1928, 1929, 1931, 1934, and 1937 the patient received treatment at the radium springs of St. Joachimstal in Bohemia, consisting of radium emanation potions, radium packs, radium baths, and, most important of all, 2 injections of radium chloride, corresponding to 0.005 mgm. of radium element each, into the right knee capsule (given in 1929). There was a satisfactory result, as far as the arthritic symptoms were concerned, but in the fall of 1937 gradually increasing pain developed in the right knee, followed later by the appearance of a definite tumor. At the examination made in September, 1938, a radiation osteitis of the bones of the knee joint associated with fibrosarcoma of the upper end of the tibia was found. A high amputation of the limb was performed and the bones were analyzed for the amount of radium salt remaining in them.

There can be no doubt that the fibrosarcoma was caused by the action of the radium. The interesting feature is that the quantity was exceedingly small, only 10 micrograms (1/100,000 gm.) of radium chloride being injected, but apparently even the minutest amounts of radium become harmful if they are allowed to act for a long period of time.

The author takes the opportunity to warn against the danger of injecting radio-active substances (thorium dioxide) into the system for diagnostic purposes, as practiced, for instance, in hepatography and leinography. Slowly accumulating animal-research observations seem to support this view.

TRAIAN LEUCUTIA, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Shumacker, H. B., Jr., Lamont, A., and Metcalf, W.: Studies in Cross Circulation. *Arch. Surg.*, 1939, 39: 959.

The authors performed experiments on dogs using Firor's method (*Am. J. Physiol.*, 1931, 96: 146) for crossing the circulations of 2 animals. The procedure consists of an end-to-end anastomosis of the carotid artery of one dog with the jugular vein of another, and vice versa. This is a reliable method for providing adequate mixing of the blood, and physiological observations are made during the procedure. The following summarizes the results of the authors' experiments:

During cross circulation of dogs of approximately equal size no net loss of blood from one dog to the other was observed. In a few instances in which dogs with very different blood volumes were used for cross circulation a net loss of blood from the larger dog to the smaller took place. The arterial blood pressure is not the primary factor in the shift of blood. The loss of blood may be sustained by the animal with the lower pressure.

During cross circulation there is almost invariably an absolute increase in the combined total blood volume of the 2 animals, effected almost entirely by an increase in the total circulating red-cell volume.

There is usually a definite fall in mean arterial blood pressure when the cross circulation is begun, after which there is a rise toward the normal level.

The pulse and respiratory rates of dogs during cross circulation may be different. The temperature of a normal dog rises when cross circulation is established between it and a dog with an experimentally induced fever (tetanus).

There is approximately complete mixing of the formed and chemical elements of the blood within two and one-half minutes after cross circulation is begun. If during cross circulation one chemical element (dextrose) is constantly supplied to the blood stream of one animal in greater quantity than to that of the other or if it is utilized by one dog more rapidly than by the other, the concentration will not be equal in the two animals.

SAMUEL H. KLEIN, M.D.

Carlström, B., Myrbäck, K., Holmin, N., and Larsson, A.: Biochemical Studies on B_1-Avitaminosis in Animals and in Man. *Acta med. Scand.*, 1939, 102: 175.

The disturbances in the organism arising in connection with Vitamin-B_1 deficiency are now generally considered to be due to a reduced capacity in the body cells to convert carbohydrates, conditioned by the fact that the oxidative breaking-down of pyruvic acid—an intermediate product in the splitting of carbohydrate—cannot take place without the help of Vitamin B_1, or possibly the latter's pyrophosphoric acid ester, cocarboxylase. The supply of Vitamin B_1 is rather uncertain since: (1) it is not formed within the organism (except in ruminants), (2) it is not stored in any considerable quantity, (3) its supply in the food is subject to great variations, and (4) resorption is reduced by disturbances of the mucous membranes of the stomach and intestine. The need for B_1 increases with heightened metabolism (Cowgill), with pregnancy and lactation, with cold, and with fever.

In this study the blood chemistry in various animal species and human beings was studied, both in health and when B_1-avitaminosis was suspected. In the latter cases relief by treatment with B_1 corroborated the diagnosis. The following substances were determined: pyruvic acid (as bisulfite-binding substance); acetone bodies; lactic acid; pyruvic acid by reduction to lactic acid and subtraction; pyruvic acid by hydrazone precipitation; and d-ketoglutaric acid. Chemical results from 10 rats and from guinea-pigs with experimental B_1-avitaminosis, from blue-foxes, from cattle, from horses, and from patients are given. The examples from human disease are not typical of recognized clinical B_1-avitaminosis. However, the authors conclude, "the changes in the blood picture in respect to blood constituents investigated have the same trend in all the animals and in man, viz., an increase in the pyruvic acid content of the blood, often an increase of the lactic acid, and a more or less conspicuous increase of the acetone bodies, an increase which may sometimes be entirely absent and sometimes be extremely conspicuous. On treatment with aneurine (thiamin) in these morbid conditions, the blood picture returns toward its normal state at the same time as the clinical symptoms disappear."

PAUL STARR, M.D.

Gillespie, E. H., Devenish, E. A., and Cowan, S. T.: Pathogenic Staphylococci: Their Incidence in the Nose and on the Skin. *Lancet*, 1939, 237: 870.

By means of intensive bacteriological studies, Gillespie, Devenish, and Cowan were able to show that three main types and six subtypes of pathogenic staphylococci were present in a carrier state in the nose and skin of healthy individuals. They believe that this carrier state is an important factor in wound infection. Of 159 persons examined, 69 (43.4 per cent) were positive nasal carriers, and 31 (19.5 per cent) were skin (wrist) carriers of pathogenic staphylococci. The association of the skin carrier state with heavily infected noses is striking, 13 per cent of the total carriers being double carriers. The length of sojourn in hospitals had no bearing on the carrier state, but the incidence of nasal carriers was

definitely higher in those individuals who gave a history of chronic nasal disease. Skin infections, boils, and pustules did not seem to influence the carrier state.

A second survey made from four to five months after the original survey showed that the nasal carrier state was relatively constant and chronic.

A group of known skin and nasal carriers was subjected to a routine operative scrub-up, and their hands were then made to sweat into gloves. Of 15 skin carriers tested 5 were shown to have a deep skin infestation as shown by positive cultures taken from the inside of the gloves. Hence, the authors conclude that about 5 per cent of the population has a deep skin-carrier state of pathogenic staphylococci. This skin-carrier state depends on the nasal-carrier state, which in turn is often associated with a history of chronic nasal disease. LUTHER H. WOLFF, M.D.

Caminiti, S.: The Practical Application of Microculture of Tubercle Bacilli in General Surgery (La portata pratica della microcultura del bacillo di Koch in chirurgia generale). *Arch. ital. di chir.*, 1939, 57: 155.

Since the discovery of the tubercle bacillus by Robert Koch in 1884 we have perfected the methods of demonstrating these bacteria in tissues and pathological products. At first the staining methods for demonstrating the morphology were developed; later the methods of culturing the tubercle bacilli were evolved. The contributions of Koch, Nocard and Roux, Capaldi, Dorset, and Petroff are described in detail. For destroying banal bacteria and contaminating organisms 10 per cent sulfuric acid and malachite green have been added to culture material and media (Petroff, Petragnani, and Loewenstein). Nevertheless, these procedures have up to the present time been applied only in the laboratory because of the comparatively long time (from twenty-five to forty days) necessary for the development of the colonies. Likewise, the biological method of inoculating guinea-pigs is slow, requiring from six to seven weeks, and has other draw-backs, such as possible contamination or accidental infection of the guinea-pig. Kurt Mayer suggested the microscopic examination of material obtained from the surface of a culture on solid media. In this manner he successfully studied sputum, urine, pleural exudates, and spinal fluid. The urologists have quickly adopted the method to aid in the early diagnosis of renal tuberculosis. In 1932 Saenz and Eisendrath studied 57 urogenital cases by this method and in 30 of these cases demonstrated tubercle bacilli in from eight to ten days, while other methods had proved negative. Bonino has noted that in urogenital tuberculosis the biological test is positive in 60 per cent of the cases, direct study of the material is positive in 50 per cent, and microculture is positive in 100 per cent.

The author has used the slightly modified technique of Bonino and Ascoli in studying the material obtained from 16 clinical cases. One or two drops of pus obtained under sterile conditions is spread with a platinum loop over the surface. The material is incubated at 37.5 degrees C. If the surface of the medium seems to get too dry a drop of sterile distilled water or glycerinated broth may be added by means of a pipette. After seven or eight days the material is examined microscopically every three days. It is considered negative if no tubercle bacilli have been demonstrated after from eighteen to twenty days. With contaminated secretions and tissue products the material is treated with sulfuric acid, neutralized, and centrifuged; the liquid material is used for inoculating the solid medium and incubating. It is particularly important to inoculate a sufficient number of tubes, since it is possible that several may be contaminated during the process of inoculation. Also, various dilutions of the material may be used to inoculate the cultures (this procedure tends to dilute contaminating bacteria).

In brief, the above technique was successfully used in: 3 cases of tuberculous adenitis; 3 cases of tuberculosis of the spine; 3 cases of tuberculous osteoarthritis at the shoulder, ankle, and knee; 1 case of perirenal abscess; 1 case of spina ventosa; and 2 cases of tuberculous pleural empyema. In all these cases the microculture of tubercle bacilli was positive from nine to fifteen days after inoculation of the culture media. In 1 case the material obtained from a gland at biopsy was positive. In 2 cases the material was negative and the subsequent clinical course indicated the absence of tuberculosis. This experience justifies the wider use of the procedure in general surgery, as a practical method for the early demonstration of tubercle bacilli in tissues and fluids, even when contaminated by other bacteria.

JACOB E. KLEIN, M.D.

DUCTLESS GLANDS

Hartman, C. G.: Studies on Reproduction in the Monkey and Their Bearing on Gynecology and Anthropology. *Endocrinology*, 1939, 25: 670.

This paper was delivered before the American Association of Anatomists in April of 1939 and rather informally summarizes observations on the physiology of the reproductive system of the monkeys in the Carnegie monkey colony. Accurate dates of the menstrual flow were recorded. Five hundred cycle lengths were plotted in a frequency curve which demonstrated the fact that irregularity was the rule. These observations compared with those reported by Ball suggest that the human species and rhesus monkeys behave very much alike with respect to the length of the menstrual cycle. A large number of monkeys in the author's colony have been reared from conception to maturity, and on this group observations of the first menses and of ovulation have been carefully recorded. The time of ovulation has been determined by palpation and repeated exploratory laparotomies. Non-ovulatory cycles were not uncommon. This finding is quite common in human beings from studies appearing in the gynecological literature. The writer had equivocal success in at-

tempting to bring about ovulation in some of these deficient animals by using gonadotropic hormones. The time of ovulation was determined by the study of more than 100 eggs and embryos as well as by palpation and isolated coitus. Ovulation, when it occurred, took place between the eighth and sixteenth days with very few exceptions.

The following factors were ascertained and comparisons were made between the rhesus monkey and man: the characteristics of the earliest implantation of the ovum and reaction of the maternal tissue; the characteristics of the pregnancy urine; the content of gonadotropic hormone; the intrauterine growth rate; the period of gestation; and the maturity of the newborn. The author found that whereas the human ovum penetrates the uterine epithelium and burrows into the stroma, the ovum of the monkey remains superficial. In man prolan is found in the urine throughout gestation with a brief but marked increase around the sixtieth day; in the chimpanzee a positive test is observed only in the second and third and part of the fourth month of the eight and one-half months' gestation. In the monkey prolan is excreted for only one week between the eighth and twenty-fifth days of gestation. Until about the thirtieth day man and monkey have about the same growth rate. After the first month the monkey embryo grows somewhat faster than the human embryo, and at about the twentieth week the man and monkey embryos are about the same size. The monkey at birth is relatively mature being capable of holding on to the mother at the instant of birth.

The writer suggests that the similarity of the rhesus monkey to the human species makes observations on the physiology of the reproductive system in monkeys of practical value to the field of gynecology. R. W. RAWSON, M.D.

Lucchetti, G.: The Action of Testosterone Propionate on the Genital System, Hypophysis, Thyroid, Thymus, Insular Apparatus of the Pancreas, and Suprarenal Glands of Castrated Rabbits (Azione del propionato di testosterone sul tratto genitale, sull' ipofisi, sulla tiroide, sul timo, sull' apparato insulare del pancreas e sui surreni di coniglie ovariectomizzate). *Ginecologia*, Torino, 1939, 5: 641.

Lucchetti's experiments have shown that testosterone propionate injected into castrated rabbits possesses a biological action equal to that of folliculin on the genital apparatus, the hypophysis, the thymus, the thyroid, and the suprarenal glands, in that it is capable of causing regression of the changes produced by castration when these changes are already established and of preventing their appearance when the testosterone propionate is administered immediately after castration has been performed. This estrin-like action was strongest with doses varying from 15 to 35 mgm. per kgm. of body weight given in thirty days and was much less marked with high doses (70 mgm. per kgm. of body weight given in the same time); this makes the analogy in the biological activity of the two hormones still more evident. The folliculin-like action of testosterone propionate, although undoubted with the mentioned doses, is not as constant as that usually obtained with folliculin.

In the uterus, the substance produces an increase in volume with moderate hypertrophy of the musculature and conspicuous hypertrophy of the mucosa, in which the hypertrophying and hyperplastic actions are similar to those of estrone and take place in the epithelium and in the mucosal corium. In the vagina, the substance causes in 33 per cent of the cases a typical estrual reaction with transformation of the epithelium from the single-layered cubical or cylindrical type to the many-layered flat type, in which the division into basal, functional, and horny layers is evident. The corium shows the formation of papillas and assumes the aspect of young connective tissue. In 25 per cent of the cases, the reaction is of the pro-estrual type and, in the remaining 42 per cent, the vagina remains the same as in non-treated castrated animals.

In the hypophysis, the substance causes regression of the typical alterations due to castration, consisting especially in a decrease of the eosinophil cells and a decrease or disappearance of the castration cells.

Following castration, the thyroid undergoes progressive changes characterized microscopically by numerical decrease and shrinking of the vesicles and by increase of the intervesicular epithelial tracts; administration of testosterone propionate leads the thyroid back to normal macroscopically and microscopically; it decreases its size as compared to the thyroid of castration, increases the number and size of its vesicles, and reduces the intervesicular epithelium.

The thymus is hypertrophied as a result of castration; there is, especially, hyperplasia of the lymphocytoid elements, principally in the cortical part, with consequent change in the relationship as to size between the cortex and the medulla. Administration of the male hormone causes these changes to disappear, and at times the regressive action goes so far as to induce a condition of hypoplasia and hypotrophy.

In view of the marked variability of the histological aspects of the pancreas found even in the normal controls, it was impossible to demonstrate histological peculiarities which would suggest functional changes induced by castration or by the treatment with the male hormone.

In the suprarenal glands, castration causes a hypertrophy of the fasciculated zone of the cortex in which there is evidently a hyperplasia and hypertrophy of the epithelial cells which assume the characteristics of spongiocytes more markedly than in the normal case. These changes undergo decided regression after treatment with testosterone propionate.

It is probable that the action of the male sex hormone on the uterus, on the vagina, and perhaps on the thymus is a direct action, while that on the thyroid and on the suprarenal glands is indirect

through the hypophysis by means of an inhibition of the incretion of the thyrotropic and corticotropic hormones. RICHARD KEMEL, M.D.

EXPERIMENTAL SURGERY

Cannon, W. B.: A Law of Denervation. *Am. J. M. Sc.*, 1939, 198: 737.

A great neurologist, Hughlings Jackson, some fifty-five years ago pointed out that a hierarchy of functions exists in the central nervous system, so that when there is a destructive lesion affecting higher functional levels a dissolution takes place. This is characterized by loss of control of the higher nerves over the lower, and by an increased activity of the lower levels, now released from dominance from above. It is doubtful if Jackson ever thought that the two conditions, release and hyperexcitability, both due to permanent damage, might combine to produce inordinate movements.

At the Harvard Physiological Laboratory some interesting studies have been conducted for a number of years. These studies have been concerned with the increased sensitiveness to chemical stimuli which appears in structures that have lost their proper nervous connections. The author reviews the results of these studies as well as the related results of other investigators. He points out that because of the regularity of the appearance of the phenomenon in the various organs which have been studied, and also because of his conviction that, if tested in other organs, the phenomenon would continue to be observed, a law of denervation is being revealed. This law can be formulated thus: when in a series of efferent neurones a unit is destroyed, an increased irritability to chemical agents develops in the isolated structure or structures, the effect being maximal in the part directly denervated.

The author proceeds to describe pertinent instances of this law of denervation. His first illustration concerns itself with smooth muscle when deprived of its stimulatory adrenergic fibers. If, for example, the dilator muscle of the iris, innervated by such fibers, has been paralyzed by their section and degeneration, the pupil, in certain conditions, is more widely dilated on the paralyzed side than on the normal side. This "paradoxical pupillary dilation" was long a mystery. In 1903 Anderson proved that the extra withdrawal of the denervated iris, which attended emotional excitement, dyspnea, and anesthesia, was due to a local stimulation of the paralyzed radial fibers. He noted, furthermore, a similar phenomenon in the denervated nictitating membrane. This paradox of a magnified contraction of muscles which were no longer under nervous government Anderson attributed to an increased excitability, but he offered no evidence as to the exciting agent. Later investigators showed that in conditions of emotional excitement and asphyxia, adrenaline is discharged into the blood stream. The adrenaline is the exciting agent. Elliott reported that slight excitement of a cat induced the paradoxical reaction in its denervated iris and that the phenomenon disappeared when the adrenal glands were removed.

Hampel and Simeone traced the course of increasing sensitivity of the nictitating membrane after removal of the superior cervical ganglion and found that for about a week it became rapidly more responsive than the normal membrane to graded doses of adrenaline, and thereafter underwent a more gradual change until a maximal state was reached at the end of from fourteen to sixteen days. This state may continue for many months. It was demonstrated, however, that if the nerve supply to a sympathetically denervated nictitating membrane regenerates, the increased sensitiveness gradually declines and finally reaches its previous grade.

An effect quite as remarkable as sensitization by cutting the ultimate adrenergic fibers is a moderate sensitization by cutting preganglionic fibers.

The augmented sensitiveness of smooth muscle disconnected from the spinal cord has importance for clinical problems. In Raynaud's disease, for example, denervation of the overcontracted vascular muscle may abolish its spasm, but the muscle becomes exquisitely responsive to circulating adrenaline. The evidence is now clear that by means of decentralization the constricted state of the vessels can be overcome without rendering them extremely subject to a circulating adrenaline.

So far it has been seen that when *stimulatory* adrenergic fibers degenerate, the smooth muscle, which they formerly supplied, becomes more than normally responsive to adrenaline. The same condition is true with regard to sympathin, the circulating chemical agent present in the blood after sympathetic stimulation. The question arises if destruction of *inhibitory* adrenergic fibers is followed by a greater effectiveness of adrenaline in eliciting inhibition. Experimental studies by a number of investigators have given the answer to this question. It appears that severance of either stimulatory or inhibitory adrenergic fibers is followed by sensitization of the denervated smooth muscle to natural chemical agents. Further studies have demonstrated that not only is smooth muscle rendered more responsive to adrenaline when its adrenergic fibers are destroyed, but also that smooth muscle is sensitized to pilocarpine and acetylcholine by destruction of its cholinergic fibers.

The next consideration concerns itself with glands. Do glands likewise respond to a greater degree to chemical stimuli after they have been freed from nervous control? Evidence on this point has come mainly from extensive studies on the lacrimal and submaxillary glands, which the author explains in great detail. These studies demonstrate conclusively that glands, like smooth muscle, become more readily responsive to chemical agents when deprived of their nervous connections.

Step by step and explaining in full detail, the author demonstrates the phenomenon of sensitization when skeletal muscle or peripheral or spinal neurones are fully or, in some instances, partially

denervated. Also, to some degree smooth muscle, glands, and skeletal muscle are thus affected if penultimate, and possibly antepenultimate neurones are destroyed. All of these instances clearly point to the law of denervation formulated by the author.

As far back as 1880 Claude Bernard, on the basis of relatively few observations, expressed the opinion, "the excitability of all tissues seems to augment when they are separated from the nervous influence which dominates them," a remarkable instance of perspicacity. Thus scientists of our own day are uncovering the law of sensitization of denervated structures concerning which the scientists of a former day conjectured. Future investigators may further uncover the possibility that tumors, and such lesions of the motor area of the cortex as are associated with the name of Hughlings Jackson, may induce instability of the neighboring cortical cells by destroying their connections with other cortical cells.

MATHIAS J. SEIFERT, M.D.

Willis, R. A.: The Experimental Study of Tissue Transplantation and Its Bearing on Surgery. *Australian & New Zealand J. Surg.*, 1939, 9: 119.

Transplantation of living tissues from one individual to another of the same species—homoiotransplantation—may be performed with two different classes of tissues: (a) fully differentiated tissues from adult or young animals, or (b) immature incompletely differentiated tissues from embryos or fetuses. Some of the results obtainable experimentally with embryo grafts in young or adult animals are described, the success of embryo grafts is compared with that of their adult counterparts, and some suggestions as to the possible therapeutic value of the transplantation of embryo tissues in human beings are advanced.

Many kinds of adult tissue can under suitable conditions be successfully grafted from one individual to another of the same species. Apart from matters of technique, such as asepsis and manipulative care, the success or failure of homoio-grafted tissue depends on many conditions, some of them already well defined, but others obscure and demanding further research. The better defined of these conditions may be briefly enumerated.

1. The nature of the grafted tissue. Some tissues can be homoio-grafted more successfully than others; for example, cartilage and ovary give higher proportions of takes than skin or ductless glands.

2. The state of subdivision of the grafted tissues. Many workers have found that minced or finely sliced tissues transplant better than bulky masses. The latter are apt to suffer extensive central necrosis which militates against the survival and establishment of viable peripheral parts of the grafts. Small pieces are better able to survive probably because, prior to their acquiring a vascular connection with the host tissues, they can more readily obtain nutritive substances and oxygen by simple diffusion.

3. The age of the grafted tissues. As might be expected, young healthy tissue takes much better than senile tissues. Embryo tissues are particularly favorable for obtaining successful grafts.

4. The site of implantation. Well vascularized stationary regions undoubtedly provide better implantation sites than do moving, poorly vascularized regions. Hence, various experimental workers have preferred the spleen, kidney, testis, bone marrow, or brain to the subcutis or peritoneal cavity as sites for implantation.

5. The age of the host animal, as might be expected, influences the fate of grafts, young growing animals giving much more successful results than full grown adults. In very old hosts it is unusual to obtain successful homoio-grafts of any kind of tissue.

6. Physiological "demand" in the host appears to be an important factor, especially as regards homoiografts of ductless glands.

7. Consanguinity and genetic relationship improve the results of homoio-grafting. Transplants between close blood relations, for example, between litter-mates, succeed more frequently than those between unrelated animals; and the same applies to transplants between members of closely inbred families.

8. Blood compatibility of donor and recipient has been thought to be of importance, especially for skin grafting.

9. Ill-defined individual peculiarities certainly play a part, and these are probably bound up with the genetic and endocrine make-up of the individual. Thus in a group of animals of more or less similar age, sex, health, and family relationship, similar transplants made into the same site of each will take well in most, but will completely fail in one or two, or will fail in most, but will take well in one or two. It thus seems necessary to postulate the existence of individual tissue specificity or peculiarity—individuality in a biochemical sense.

From the experiments described, it is clear that in the rat, at least, most kinds of embryonic tissues readily yield successful grafts when transplanted in young or adult animals. The frequency of "takes" of such grafts is much greater than that of the corresponding adult tissues. The inflammatory tissue reaction which is commonly present around adult tissue grafts, is often slight or absent around successful embryo grafts. Epidermis, of which adult homoiografts are seldom successful, readily survives and grows when embryo grafts are used. The same applies to many other epithelia, those of mucous membranes and various external secretory glands. Bony tissue from an embryo evidently survives transplantation no better than adult bone; but cartilaginous precursors of parts of the bony skeleton transplant well and differentiate into bone. Successful grafts will probably be readily obtainable with the thyroid, the anterior pituitary gland, and the testis. Striated muscle fibers and hemopoietic bone marrow, both of which are readily obtainable in embryonic grafts, have never been observed to survive in adult tissue transplants. The actual frequency of success of embryo grafts of various tissues cannot be assessed from

the experiments to date. These have been performed with embryo and fetal tissues of various ages in hosts of various ages, and other factors also have varied from experiment to experiment. And it can be said of most kinds of transplanted embryo tissues in healthy young rats that the cases with successful grafts presenting every histological sign of health and permanency outnumber those in which the tissue fails to survive.

Successful grafts of embryo tissues differ from those of adult tissues in two important respects:

1. Rate of growth. Embryo tissues possess great "growth momentum"; their cells are undergoing repeated mitosis at short intervals, and all other potential cell functions are in abeyance in favor of nutrition and rapid multiplication. In transplants of such tissues the cells retain their avid nutritional power and growth impetus; the rate of growth of the transplanted tissues may equal that of the corresponding tissues in the intact fetus and young animal.

2. Progressive differentiation. Evidently differentiation of the transplanted tissues in the experimental rats is retarded little or not at all by subdivision of the tissues and by the strange environment in which they are placed, but progresses at rates not much different from those obtaining in the intact organism. The most striking instances of uninterrupted normal differentiation in grafts are those of teeth and bones. A fully developed normal tooth 4 mm. long can develop in a few weeks from a minute undifferentiated tooth germ included in a fine mince of embryo jaw, and a structurally normal and anatomically identifiable femur or tibiofibula nearly 2 cm. long can develop in a few weeks from an appropriate cartilaginous rudiment only 1 mm. long.

Since, as the experimental results clearly show, embryo tissues can be much more successfully transplanted than adult tissues, they may be preferable in cases in which homoio-grafting is indicated.

Ample suitable material is not difficult to procure. Fresh sterile embryos or fetuses are frequently available from cases of miscarriage, ectopic pregnancy, or therapeutic termination of pregnancy. Such embryos, placed in normal saline or Ringer's solution in a sterile container, will be a suitable source of tissues for grafting probably for some hours; though, of course, it would be preferable to perform transplantation immediately. Needless to say, any suspicion of fetal infection or of maternal syphilis would necessitate discard of the fetus for grafting purposes; and it would be advisable that the maternal blood should have been subjected to the Wassermann test in all cases. The best material for grafting will be obtained at deliberate termination of pregnancy in cases of cardiac disease, tuberculosis, or diabetes, in which the products of gestation are almost certainly "clean," and a Wassermann test of the mother's blood can be made beforehand. The optimum age of the human embryo for grafting purposes can only be determined by trial; it probably varies from tissue to tissue. Judging from the experimental results with rat embryos, the tissues of human embryos of between six and twelve weeks may be expected to give more successful grafts than those of older fetuses.

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